INSTITUTE FOR SUSTAINABLE FUTURES

Institute for Sustainable Futures

SMART GRID, SMART CITY
CUSTOMER RESEARCH REPORT

2014

ARUP ENERGEIA frontier economics

ABOUT THE AUTHORS

The Institute for Sustainable Futures (ISF) was established by the University of Technology, Sydney in 1996 to work with industry, government and the community to develop sustainable futures through research and consultancy. Our mission is to create change toward sustainable futures that protect and enhance the environment, human well-being and social equity. We seek to adopt an inter-disciplinary approach to our work and engage our partner organisations in a collaborative process that emphasises strategic decision-making.

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TABLE OF CONTENTS

TABLE OF TABLES

TABLE OF FIGURES

Executive Summary

KEY FINDINGS

Supply priorities:

- 'Cost of bills' and 'maintaining a reliable supply' were rated equal-highest as the most important issues relating to energy supply by customers. Smart meter safety issues, and privacy of energy consumption data were rated to be of lower importance than other issues.

Increased control:

- Customer app products were found to have a very positive effect on customer awareness of energy use, and almost 70% of participants felt that their ability to reduce bills had improved.

Behaviour change:

- 83% of participants reported that the use of their product had resulted in them taking some action to reduce or change how they used electricity. Two-thirds said they reduced their usage, 58% said they changed the time of day that they used electricity, and a quarter said they made one or more appliance efficiency upgrades.

Feedback technologies:

- Almost no participants said their feedback device gave them too much information, and the more information that was provided to households about their electricity use, the more they wanted.
- In-home displays strongly increased customer frequency of engagement with electricity data compared to the Online Portal, while the Online Portal + Home Area Network (with detailed appliance tracking and control features) was as powerful or more powerful than the in-home display at driving bill reductions.
- Products that combined feedback technologies with a pricing/incentive structure had the strongest impact on customer energy awareness and ability to reduce bills.

Peak event products:

- Almost 9 out of 10 households reported participating in a peak event. The incentive-based Peak Rebate product inspired 10% higher participation than the tariff-based peak pricing product.
- Over 80% of households maintained or increased this interest in participating in peak events over time while two-thirds of households reported that their participation in peak events had flow-on effects of reducing their electricity use at other times.
- People with peak event products, particularly those receiving the Peak Rebate, were more likely to report a higher perceived level of savings than people with non-peak event products.

Product satisfaction:

- Most participants were positive about the product they had trialled, with 70% being 'satisfied or 'very satisfied' and only 9% 'dissatisfied' or 'very dissatisfied'. (Note that only a small number of participants who had opted out of trial completed the survey.)
- Customer strongly favoured products that combined a tariff or incentive to promote time shifting of electricity use with a feedback technology, compared to products involving only one of the two elements.

Vulnerability analysis:

- **Financially vulnerable households** were more likely to: think that they could shift the use of a larger number of appliances outside of peak times, report greater improvements in ability to reduce bills, report higher product satisfaction and recommend their product to a friend.
- **Elderly households** were less likely to find it easy to set up and use their products, or to participate in peak events and achieve the benefits of increased awareness and control over bills. These apparent 'age effects' were offset in low income elderly households (pensioners) who more closely reflected the responses of other households.
- **Households with children:** A higher proportion of households with children reported historical difficulty in paying their energy bills, and a desire for more control over their electricity use compared to households with no children. This desire translated to higher than average time shifting of electricity use, but few other notable positive behaviour change outcomes.
- **Top electricity users:** High electricity users reported much larger financial savings through the use of their product, likely linked to higher discretionary energy use.

BACKGROUND

This customer research report has been prepared by the Institute for Sustainable Futures with assistance from the Centre for the Study of Choice at the University of Technology, Sydney. It is part of the *Smart Grid, Smart City* (SGSC) Analysis and Reporting Project undertaken by Arup, Energeia, Frontier Economics and the Institute for Sustainable Futures (the 'AEFI' consortium). As part of the overall SGSC Program, the Customer Applications Program aimed to complete a commercial-scale trial of customer products by installing and operating customer-side applications at around 7,000 domestic dwellings. These applications (pricing/incentives and/or consumption information feedback technologies) were supported by smart meter infrastructure (SMI).

The primary purpose of the Customer Applications Program was to demonstrate that:

> *Customer applications within a smart grid will have a measurable impact on reducing total electricity usage and/or peak demand in Australia.*

The customer research survey documented within this report had two distinct purposes:

1. To obtain **household profiling** data to enable a more accurate depiction of household demographics and energy profiles.
2. To analyse the **customer experience** that *SGSC* trial participants had with the products they were trialling.

The household profiling questions were asked of trial participants and a control group. For both groups, an SGSC smart meter was installed at the dwelling and the occupants were notified prior to the installation that they were to receive a new meter as part of the SGSC Program. They were told that they may be invited to trial a product or may be selected to be part of the control group. The trial group participants also had contact with the SGSC Program through the process of signing up to the trial, whereas control group participants had no other direct contact with the SGSC Program. The customer experience questions were only asked of trial participants.

Between the two deployment periods in 2013 and 2014, a total sample of 3,215 trial participant responses was received, as well as 241 control group responses obtained in 2013. All products were well represented, with between 22% and 53% of the participants trialling a given product undertaking the survey.

HOUSEHOLD PROFILING

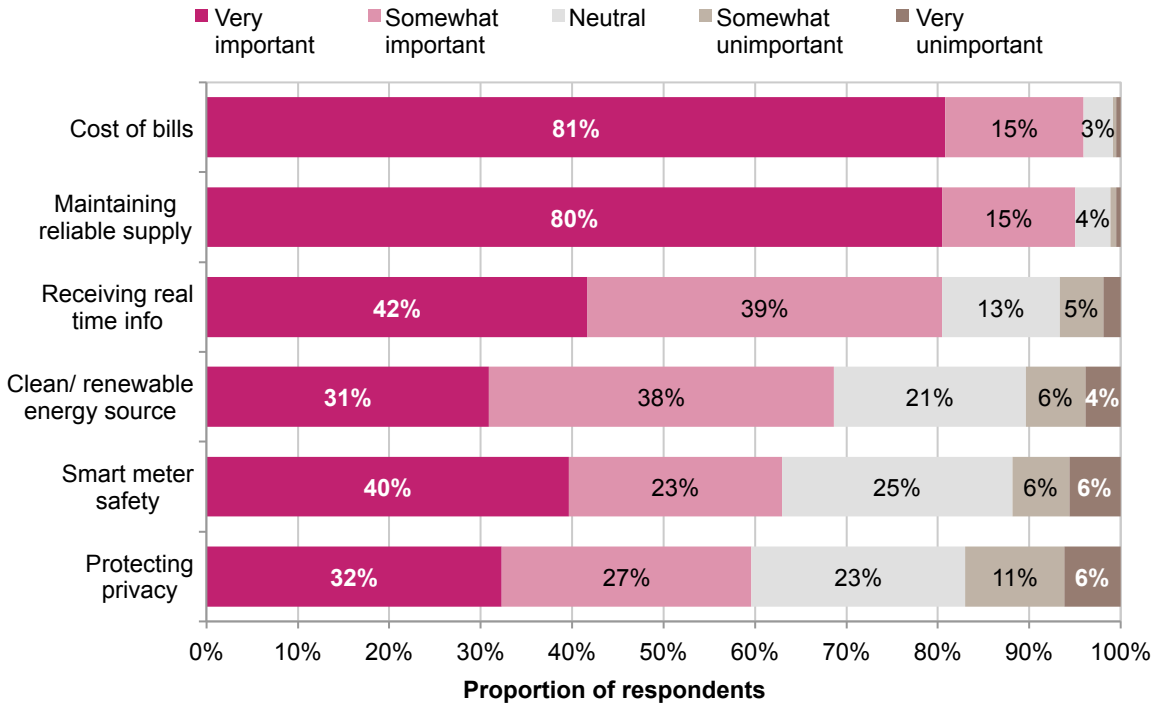
Several subtle but statistically significant differences between the trial participant group and control group were found. These confirmed several known sampling and logistical factors associated with the trial rollout.

The trial participant group was slightly more likely to live in detached houses, and own their residences outright without a mortgage. Trial participant households were more likely to be older, and speak English as a first language in the home. While the trial participant group showed a higher rate of ownership of large energy using appliances (air conditioning, dryer, pool pumps), there were no apparent differences in household income, prevalence of energy bill vulnerability, or average electricity use between groups.

When households were asked to rate the level of importance placed on factors relating electricity supply, the 'cost of bills' and 'maintaining a reliable supply' rated equal-highest as the most important issues, as shown below. Over 80% felt that receiving real time information on their electricity use was important to them, while smart meter safety

concerns and the privacy of energy consumption data rated lowest (albeit still important to almost 60% of respondents).

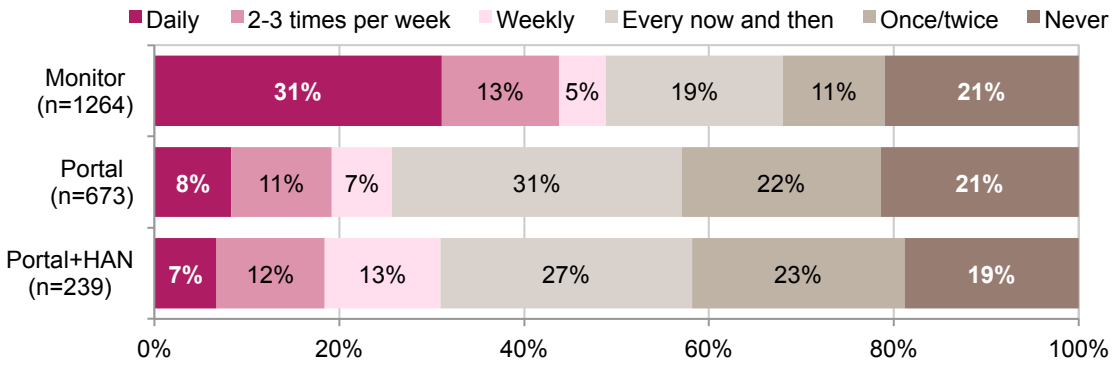
Importance placed on different priorities relating to electricity supply



PRODUCT INTERACTION

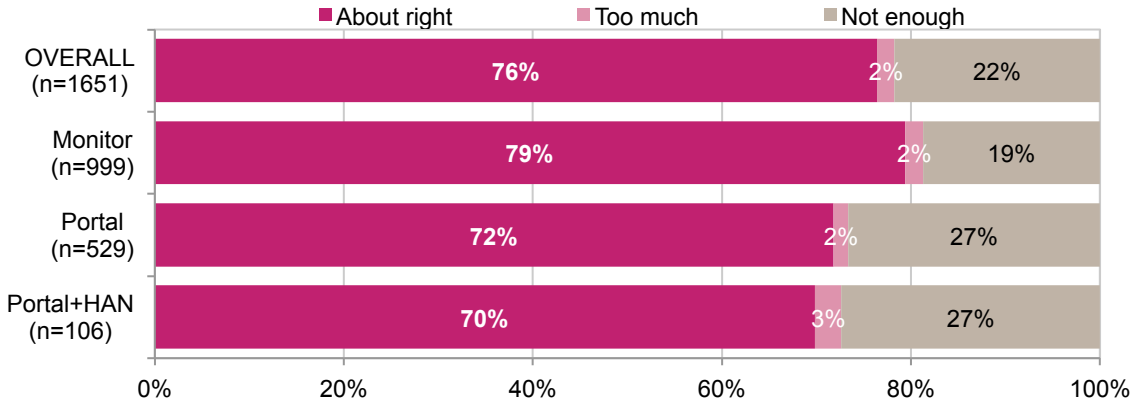
Feedback technologies – level of engagement: The program trialled three types of feedback devices: a (home energy) monitor, showing basic live energy consumption and cost data; an online portal, which showed more detailed information but required computer access; and an online portal paired with a Home Area Network (HAN). A HAN involves smart plugs that enable tracking and remote control of individual appliances. There were very diverse results for how often people used their feedback technologies, with the data suggesting a clear advantage of monitors for capturing user engagement, probably due to the lower entry barriers as the device was in sight within the home and does not require a dedicated login. On average user engagement with energy data reduced slightly over time, due to both positive (user learning) and negative (apathy) factors.

Frequency of usage of feedback technology



Feedback technologies – level of information: Three-quarters of respondents reported that the quantity of information provided by the feedback technologies was 'about right', while almost one-quarter would have preferred more information, as shown below. Almost no respondents felt that they were given too much information. Furthermore, the more information provided to customers (through the Portal and the Portal+HAN), the greater the likelihood that they wanted more.

Satisfaction with amount of feedback information



Peak event products: Some products involved discrete 'peak events' where customers were encouraged – through significantly higher prices or rebates for reduced demand – to reduce consumption for a period of up to four hours. These customers were sent SMS notifications 24 hours in advance of the event to request their participation.

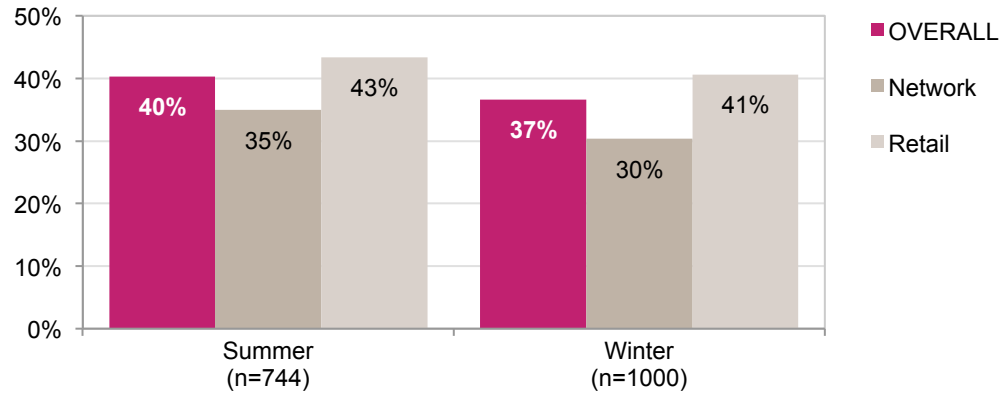
A very high proportion of respondents (87%) reported participating in a peak event and two-thirds reported that this flowed on to their continuing to change their behaviour outside of the peak event period. Continued interest in peak event participation was high, with 80% of respondents stating that they maintained or increased their level of interest in participating in peak events over time. The incentive-based Dynamic Peak Rebate performed slightly better than the tariff-based Dynamic Peak Pricing on all three measures.

When asked, 40% of respondents said they would participate in the peak event by reducing their heating/air-conditioning use regardless of how extreme the temperature was in order to save money. The remaining 60% indicated they would use their heating/air-con less on moderate temperature days but would pay more to heat/cool their house on extreme temperature days. This suggests that peak events would be less effective on extreme temperature days relative to events run on moderately hot or cold days.

A slightly higher proportion of Dynamic Peak Pricing respondents indicated they would reduce their heating/cooling on extreme temperature days compared to Peak Rebate respondents, tentatively suggesting that the 'stick' of higher prices may be slightly more effective that the 'carrot' of higher rebates on extreme hot or cold days. Refer to the *Customer Applications Technical Compendium* for analysis of observed savings during trial peak events.[1]

[1] Data can also be found at the SGSC Information Clearing House: https://ich.smartgridsmartcity.com.au

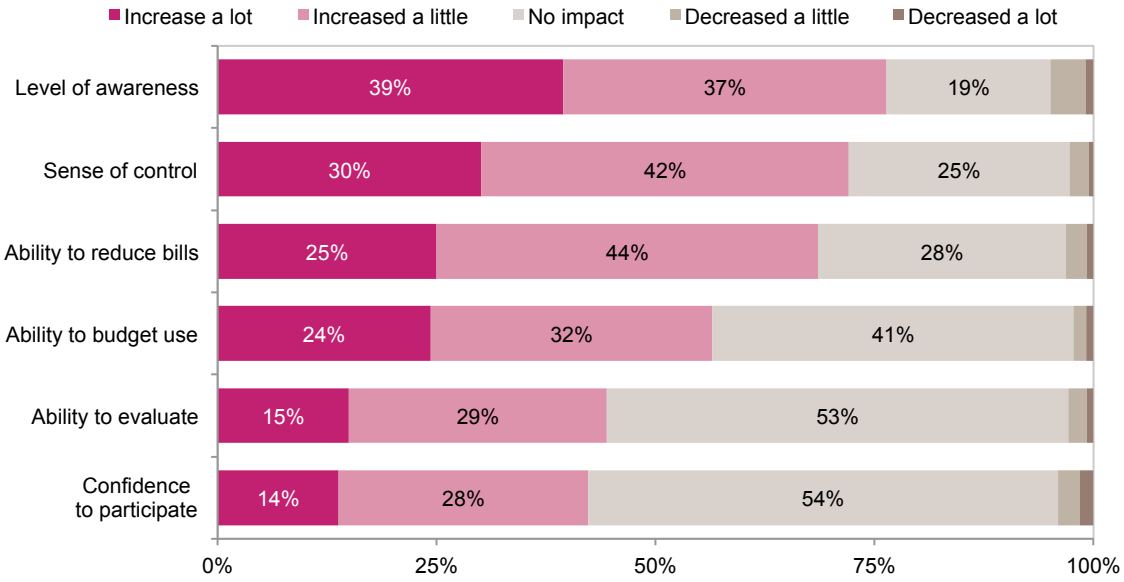
Proportion of households who would respond to peak event no matter how extreme the temperature



PRODUCT IMPACT

Awareness and control: Participants rated how the use of their product had impacted on their energy awareness, energy literacy and control over bills, as shown in the figure below. The trial was found to have had a very positive effect on awareness of energy use, which translated to almost 70% of respondents saying that their ability to reduce bills had improved.

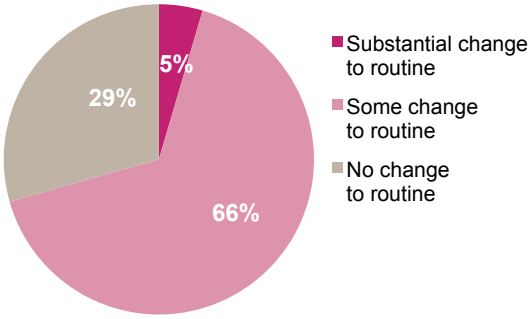
Overall impact of product use on energy awareness, control and literacy



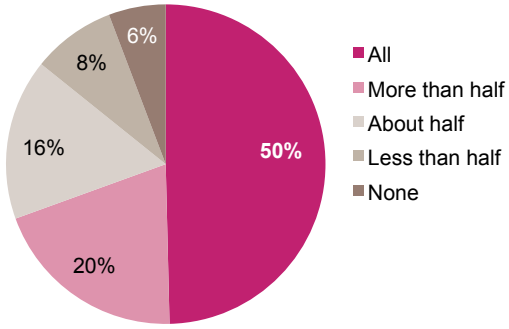
Behaviour change: 83% of respondents reported that the use of their product had resulted in their taking some action, with two-thirds reporting reducing their usage, 58% reporting changing the time of day that they used electricity, and a quarter making one or more appliance efficiency upgrade.

For two-thirds of respondents the behaviour changes reported had some effect on their daily routine, but only 5% reported them as having significantly affected their daily routines (left).

Magnitude of changes to daily routine



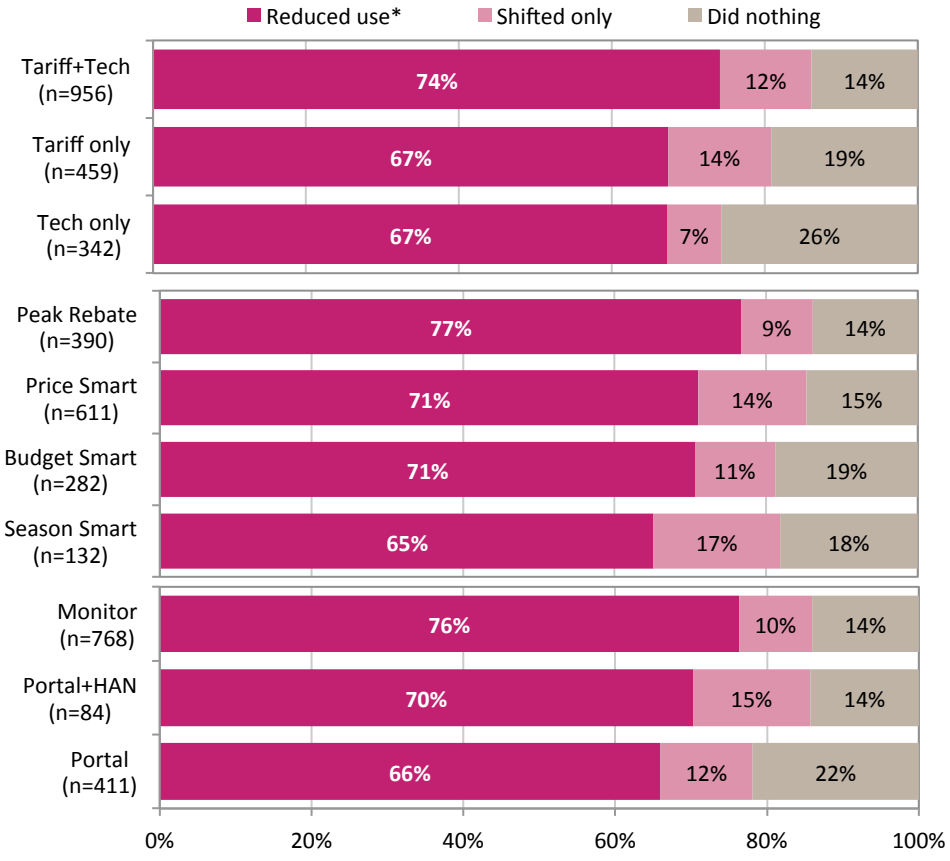
Proportion of behaviour changes still undertaking 6-18 months on



Participants were asked about the changes they were still making at the time of the survey, which was between 6 and 18 months after starting to use their product. The results suggest that the changes in behaviour that respondents implemented were relatively persistent, with half of respondents reporting that they were still implementing all of their changed behaviours and over 85% still implementing half or more (above right), even though engagement with energy data reduced over time for half of respondent households.

Consistent, statistically significant differences were found according to product type, pricing/incentive type and feedback technology type, as shown below. Products combining pricing/incentives with a feedback technology, those on peak event products, and those using monitors all reported higher rates of behaviour change.

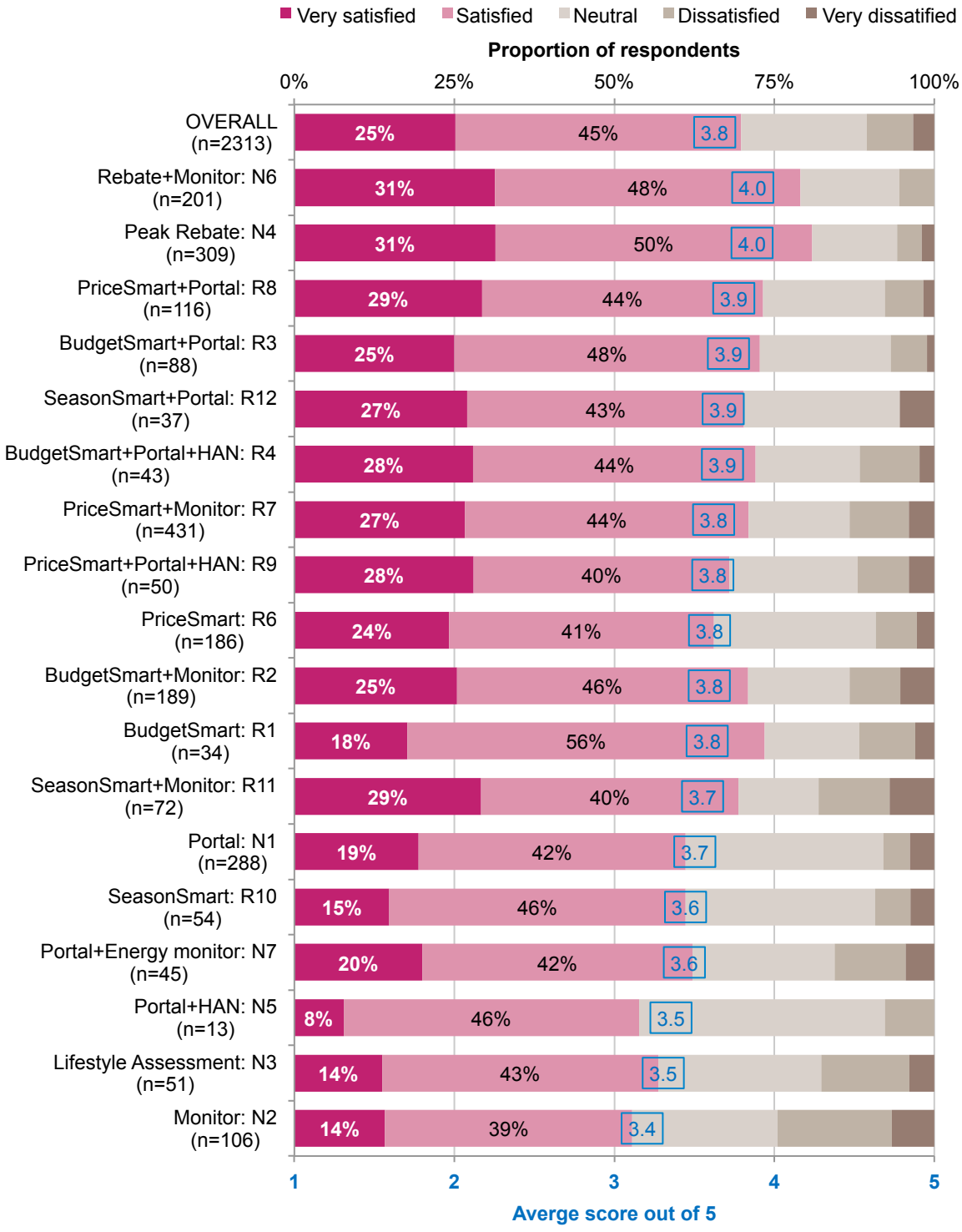
Type of reported behaviour change by product type (top), pricing/incentive type (middle) and technology type (bottom)



PRODUCT CONCLUSIONS

Product satisfaction: Overall the majority of respondents were positive about the product they had trialled, with a quarter 'very satisfied' and a further 45% 'satisfied', as shown below. Note that the two peak rebate products (N4 and N6) were the best performers, and all products in the top half involved a pricing/incentive. On average product satisfaction tended to stay relatively stable or improve over time.

Overall customer satisfaction with product



PRODUCT TYPE ANALYSIS

Comparing product types: To inform discussion on how Australian customers respond to incentives (or penalties), versus feedback technologies, or a combination of the two, results were grouped into the following trial product types:

- Pricing or incentive structures only
- Feedback technologies only
- Combinations of pricing/incentive structures with feedback technologies

The following conclusions were made:

- **Frequency of engagement:** Pricing/incentive and technology combinations were superior for encouraging customers to engage with their electricity use on a more regular basis.
- **Perception of financial savings:** Having a dedicated tariff structure or rebate to incentivise behaviour change results in customers reporting greater savings.
- **Impact on awareness and ability to reduce bills:** All products increase customer awareness of electricity use and customer control of electricity bills, but combination products show the strongest result.
- **Product satisfaction:** Providing a feedback technology alone results in lower customer satisfaction than if the product involves a tariff or incentive.
- **Overall conclusion:** While informing customers has benefits, and offering a tariff or incentive to promote time shifting of electricity use helps to save customers money, doing both optimises customer outcomes across a range of indicators.

Comparing tariff and incentive structures: To inform discussion on the most effective approach to structuring consumer tariffs and payments to achieve positive customer outcomes, the following products were compared:

- Peak Rebate (network dynamic peak event incentive payments)
- PriceSmart (dynamic peak pricing)
- SeasonSmart (seasonal time of use pricing)
- BudgetSmart (top up reward plan)

The following conclusions were reached:

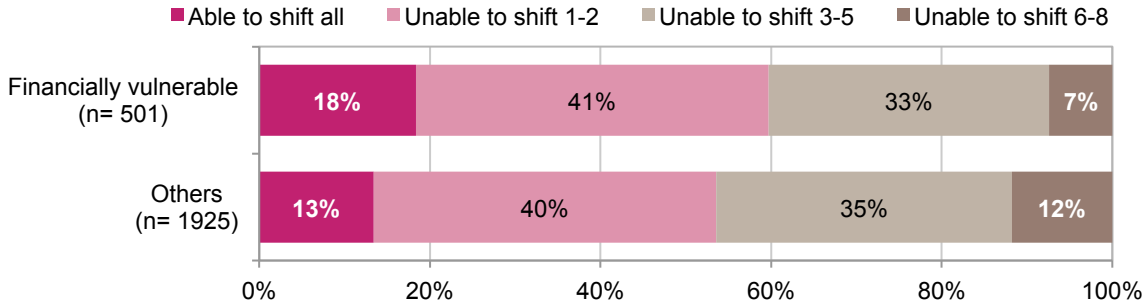
- **Frequency of engagement:** Customers with peak event products, both incentive-based (Peak Rebate) and tariff-based (PriceSmart) engaged more frequently with their feedback devices than customers with the other tariff types.
- **Perception of financial savings:** Customers with peak event products reported the largest savings, with the Peak Rebate being the strongest performer. This may be because Peak Rebate savings were discrete and put on a credit card for customer use rather than having to be interpreted off a quarterly bill.
- **Product satisfaction and likelihood to recommend:** The results suggest customers prefer peak event products to regular time of use pricing products, but that the 'carrot' (rebate) approach may resonate better with customers than the 'stick' (tariff). While BudgetSmart was not clearly favoured on most indicators, its satisfaction and 'likelihood to recommend' ratings were unexpectedly high. This may indicate that the unique feature of this product – the more deliberate and constant engagement with actual accrued bill costs – was popular with some customers.

Comparing feedback technologies: The high visibility of home energy monitors results in strong customer engagement, which has good flow-on effects in terms of awareness and customer ability to reduce bills. The online portal was generally much less successful in both regards, as the barriers to entry (having to turn on a computer and log in) were higher. However, when the portal was combined with the HAN, the additional functionality unlocks strong customer benefits. Despite not achieving a high frequency of engagement, the HAN was most successful in delivering increased ability to reduce bills.

VULNERABILITY ANALYSIS

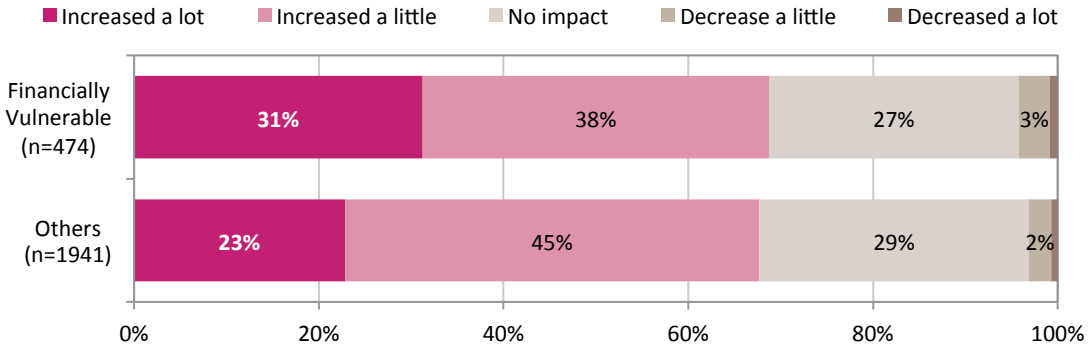
Financially vulnerable households: Financially vulnerable households were more likely than others to think that they could shift a larger proportion of their electricity use outside of peak times, with almost 60% suggesting they could shift all but 1 or 2 appliances, compared to 53% for other households, as shown below. This suggests that greater financial vulnerability increases a customer's willingness to shift load. At the same time, this group also rated the behaviour changes they did make as easier (less disruptive) than other households. This is an important finding in the context of developing products that enable financially vulnerable households to be better off in an incentive-based pricing environment.

Ability to shift major appliance use, by financial vulnerability



In terms of empowerment of consumers to reduce their electricity bills, financially vulnerable households were statistically more likely to report their ability to reduce their bills had 'increased a lot', as shown below.

Impact of trial on ability to reduce electricity use, by financial vulnerability



Financially vulnerable households were commonly more satisfied than other households with their product and were more likely to recommend their product to a friend. This suggests that households with a greater desire for control over their bills (through necessity) were more likely to obtain and appreciate the benefits offered by the trialled products.

Elderly and pensioners: A substantially lower proportion of elderly households, and slightly lower proportion of pensioner households have felt unable to pay an energy bill within the last year, compared to other households. Thus it appears that low-income households not exclusively made up of older household members have a higher incidence of bill vulnerability.

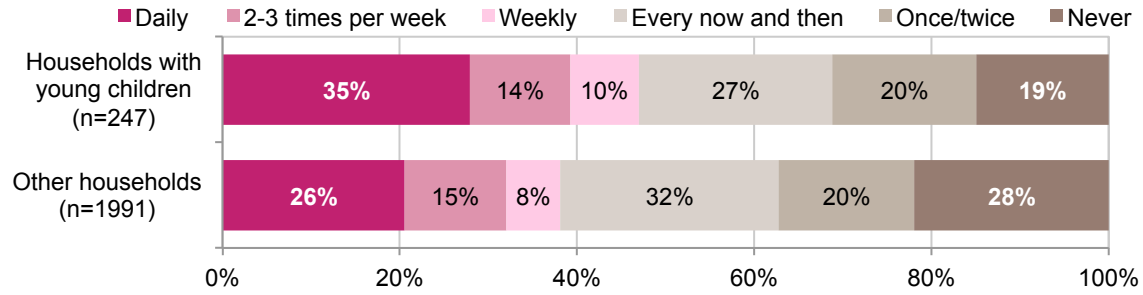
Elderly and pensioner households were no different to other households in how often they engaged with feedback technology, but they increased or maintained their level of use of the technology over time more than other households. Yet elderly households were less likely to report shifting their time of use during the trial compared to other households (50% compared to 59%) or participate in peak events. Pensioner households were not statistically different from other households in their reported time shifting behaviour during the trial, but showed slightly lower peak event participation.

This suggests that the older the household, the less likely it was to engage strongly with the product, obtain the benefits and derive satisfaction, but having a lower income offsets some of this 'age effect', bringing responses back towards the average.

Households with children: A substantially higher proportion of households with children reported feeling unable to pay their electricity bill at some time within the past year compared to households with no children, with a figure as high as the financially vulnerable group. This suggests that despite higher incomes, the larger family size and higher energy use of this group results in a similar level of bill pressure.

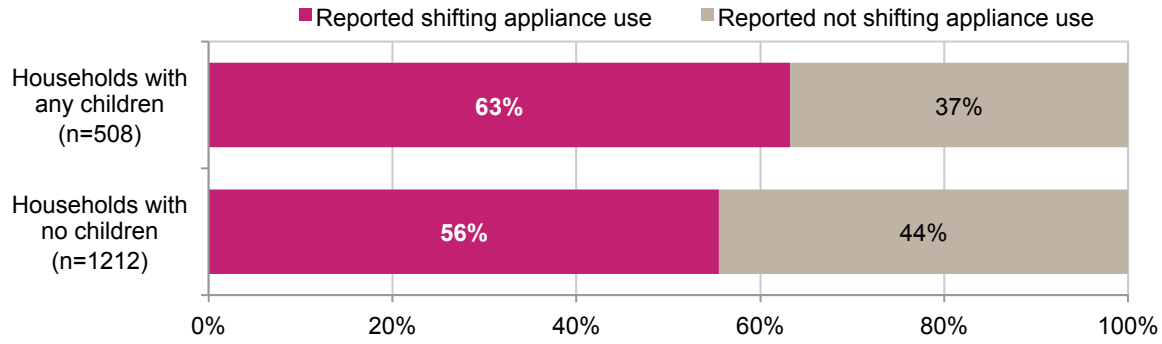
The presence of children, and particularly young children as shown below, was associated with a higher engagement with feedback technologies.

Frequency of usage of feedback technology, by presence of children



Those with children tended to engage well with the technologies, driven by a desire for increased control of bills (and possibly because they comprise a younger, more technology savvy age group). Yet this did not result in exceptionally clear positive behaviour change outcomes. There was no difference in reported reductions in energy usage during the trial for those with and without children, although households with children more often reported shifting their time of energy use in the trial, as shown below. This did not translate to higher than average participation in peak events.

Self-reported change in time of day of electricity use, by presence of children



Top electricity users: Despite being more likely to come from a higher income bracket, the top 10% and top 20% of electricity users were more likely than others to have felt unable to pay energy bills in the past 12 months. Yet the higher the electricity user, the less willing or able they were to shift the time of use of a larger number of appliances in the home, suggesting that while this group is likely to have higher 'discretionary' electricity use they are less willing to compromise on the flexibility of use *some* of those appliances. Nonetheless, the top energy user group showed higher reported load shifting participation during in the trial. This translated to higher perceived financial savings, with the highest energy users twice as often estimating saving over $45 per bill compared to other households.

ACTUAL VERSUS PERCEIVED SAVINGS

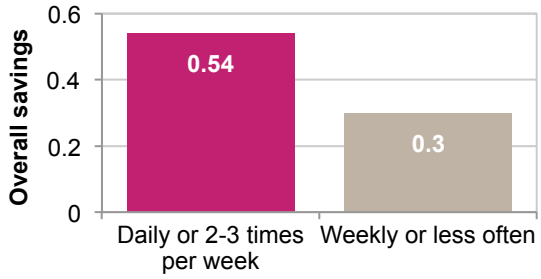
Customers' reported experiences from the trial were cross-referenced with modelled data on energy, peak and bill savings. This was done using individual household-level savings estimates, which carried a high degree of uncertainty due to the lack of consistently available smart meter data for 12 months of pre-trial electricity use for all households. While dataset limitations limit the conclusiveness of the results, the following findings were made:

- When comparing actual with perceived savings values (in $ per bill) for tariff-based products, it was found that respondents were able to roughly gauge the level of savings they were receiving on their bill, although they tend to underestimate the actual savings by a reasonable margin.
- Those who reported reducing the duration or intensity of their use of big appliances showed average savings two-and-a-half times greater than those who did not. This suggests that focussing actions on a few large energy using appliances drives more savings than changes made to the use of a range of smaller appliances.
- Actual savings for PriceSmart customers were substantially higher than for Peak Rebate customers. This is the opposite of what we would expect looking at the customer perceptions of their savings, where the Peak Rebate scored highest. This suggests that while the Peak Rebate was less effective in achieving real results, the nature of the design of this product made savings more tangible to customers relative to quarterly billed tariff products.
- Participants who said they would pay more to heat their house on extremely cold days showed slightly lower average savings on peak event days when the average temperature was 16 degrees or less. No relationship was observed for summer

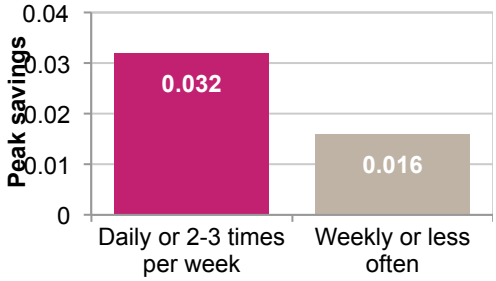
events, likely due to the lack of really extreme hot days during the trial period. This suggests that customer expectations of their likely behaviour during extreme winter days were reflected in their actions.

- Those who reported engaging with their feedback technology daily or 2-3 times per week had both higher overall savings and higher peak savings than those who only engaged with it weekly or less often, as shown below. This has important implications for designing products, which aim to reduce barriers to user interaction in order to maximise user engagement.

Engagement with feedback technology vs. overall savings



Engagement with feedback technology vs. peak savings



CONCLUSIONS

The customer research survey successfully obtained customer perspectives from almost half of all households participating in the trial. Overall, a high level of satisfaction with the customer app products was found, with customers generally obtaining higher levels of engagement and benefit from products when a pricing/incentive structure was combined with a feedback technology, particularly home energy monitors.

The most popular products tended to be those involving discrete 'peak events', but the BudgetSmart products which focussed on regular proactive customer engagement with billing were also successful. The data shows large variations in the experiences of different people with the same product, which suggests that there will not be one product that suits all customers. Diversity in product offerings is likely to be required to allow customers to choose the products they think best suit their needs.

The data suggests that financially vulnerable households and households with children have greater than average engagement with the customer app products and obtain financial benefits and satisfaction from their use. Providing a voluntary approach is taken, with room for consumer choice, these results suggest that time of use pricing appears to present a benefit rather than a threat to financially vulnerable households.

Finally, the comparison of actual savings with customer perceptions confirms that self-reported customer behaviour changes do correlate with actual delivered savings. However, those receiving rebates tended to *overestimate* the value of their financial savings, while those on dynamic tariff structures tended to *underestimate* their financial savings. Caution should be exercised when asking customers directly how much they saved, as this may be influenced by the product type or design.

1

Background

1.1 SMART GRID, SMART CITY PROJECT

Smart Grid, Smart City (SGSC) was an Australian Government program running from 2010–2014, managed by the then Department of Resources, Energy and Tourism.[2] The program was testing smart grid technologies and 'gathering information about the benefits and costs of implementing these technologies in an Australian setting'[3] and was led by the NSW network business Ausgrid, in collaboration with the retail partner EnergyAustralia.

This customer research report has been prepared by the Institute for Sustainable Futures (ISF) and the Centre for the Study of Choice (CenSoC) at the University of Technology, Sydney. It was part of the SGSC Analysis and Reporting Project that undertaken by Arup, Energeia, Frontier Economics and the Institute for Sustainable Futures (the 'AEFI' consortium).

The objective of the customer research project was to analyse the experiences that participants in the SGSC customer trials had with the products they trialled. The research investigated the "customer experience" including factors such as:

- how well products satisfied customer needs
- how likely customers were to recommend their products
- whether the products improved customer awareness, understanding and control over their energy use
- whether the products supported customers in making changes to their behaviour
- how the experiences of vulnerable groups differed from those of the broader population.

In addition, the customer research project obtained household profiling data that enabled a more accurate depiction of the household demographics and energy profiles for the trial participant and control group customers surveyed.

[2] Replaced with the Department of Industry in September 2013. The trials were also extended to capture additional data over the summer 2013-14 period.

[3] *Smart Grid, Smart City*, 2013, *About Smart Grid, Smart City,* accessed on 19 September 2013 at http://www.smartgridsmartcity.com.au/About-Smart-Grid-Smart-City.aspx

1.2 CUSTOMER RESEARCH SURVEY

1.2.1 Research scope

Two surveys were conducted approximately six months apart. Both surveys were offered to participants in the SGSC Customer Applications Program, which involved trialling a range of innovative pricing/rebate and technology feedback device combinations, and included over 8,000 participants. Over 1,700 participants responded to the initial customer research survey, while almost 2,500 participants responded to the second customer research survey, including almost 1000 from the initial survey.

Data collected from both surveys was pooled together to create a sample of 3,215. For participants who answered both surveys, only their latest responses were included.[4]

Participants from the SGSC Distributed Energy in the Smart Grid (DESG) Program were also surveyed. The SGSC DESG Program involved the installation of distributed storage/generation devices at customers' dwellings. The number of participants in the trial was small (65 in total) and the number of respondents to the survey was smaller still (19 responses in total).

As the DESG Program respondents were statistically insufficient to draw any meaningful conclusions at a product level, and their trial experiences were substantially different to participants in the Customer Applications trials, responses to DESG products have not been included in the survey data analysed in this report. Data from their responses is available in the SGSC Information Clearing House.[5]

1.2.2 Research groups

The surveys were undertaken with trial participants and, for the initial survey, with a control group. The trial group participants had had prior contact with the SGSC Program through the process of signing up to the trial and were assigned to one of 108 customer profiles based on demographic information at the time of sign up. An iPad Customer Acquisition Application (CIS) was used to record demographic data about the households and to recommend suitable trial products. The CIS data collected on trial participants has been incorporated into the dataset used in this research.

The control group was also selected to represent the 108 customer profiles based on assumed household profile information. The control group participants had smart meters installed in their houses but have not had any direct contact with the *SGSC* program (except for the notification that they would be receiving a new meter and that they may be selected to be part of the SGSC control group).

[4] To streamline the longer survey for repeat respondents, some of the profiling and energy perspective questions were not asked of these respondents in the 2014 survey. Instead their answers were drawn from their responses to the 2013 survey.

[5] Registration to the SGSC ICH is free and open to all users: https://ich.smartgridsmartcity.com.au

1.2.3 Research objectives

The objectives of this research were to:

- analyse the efficacy of different smart grid products in delivering real world benefits to customers
- understand customer perceptions of trialled smart grid products
- undertake a granular analysis of the customer experience that included consideration of how relevant socio-demographic factors influence customer experience of smart grid products
- analyse the perceived effects of smart grid products on customers' abilities to control and manage their consumption
- examine how the product experiences of vulnerable groups differ from the broader population
- compare survey respondents' own perceptions of their trial experiences and bill savings with data on total energy savings, peak demand savings and bill savings.

1.2.4 Products covered

The products analysed in this Customer Research Report are shown in Table 1 below. Three products were excluded from this survey and analysis due to recruitment difficulties which limited the potential sample size for the survey. The excluded products are:

- N8: SGSC Home Energy Air
- W1: Sydney Water Smart Meter
- R5: Flowsmart with Powersmart Online.

The electric vehicle trials also did not form part of this survey as separate surveys have been conducted of these participants.

As noted above, the following two DESG products were also excluded:

- N9: Reflow Storage System
- N10: Bluegen Gas Fuel Cell.

Table 1: Products included in the survey

Product ID	Marketing name	Pricing/Incentive	Technology*
Network trials			
N1	SGSC Home Energy Online	-	Online portal
N2	SGSC Home Energy Monitor	-	Home energy monitor
N3	SGSC Home Energy Assessment	-	-
N4	SGSC Home Energy Rebate	Dynamic peak rebate	-
N5	SGSC Home Energy Network + Home Energy Online	-	Home area network (smart plugs) Online portal
N6	SGSC Home Energy Rebate + Home Energy Monitor	Dynamic peak rebate	Home energy monitor
N7	SGSC Home Energy Online + Home Energy Monitor	-	Online portal Home energy monitor
Retail trials			
R1	BudgetSmart	Top up reward plan	-
R2	BudgetSmart with PowerSmart Monitor	Top up reward plan	Home energy monitor
R3	BudgetSmart with PowerSmart Online	Top up reward plan	Online portal
R4	BudgetSmart with PowerSmart Online & Home Control	Top up reward plan	Online portal Home area network (smart plugs)
R6	PriceSmart	Dynamic peak pricing	-
R7	PriceSmart with PowerSmart Monitor	Dynamic peak pricing	Home energy monitor
R8	PriceSmart with PowerSmart Online	Dynamic peak pricing	Online portal
R9	PriceSmart with PowerSmart Online & Home Control	Dynamic peak pricing	Online portal Home area network (smart plugs)
R10	SeasonSmart	Seasonal time-of-use	-
R11	SeasonSmart with PowerSmart Monitor	Seasonal time-of-use	Home energy monitor
R12	SeasonSmart with PowerSmart Online	Seasonal time-of-use	Online portal

** All products also included the use of a smart meter.*

1.3 DEFINITIONS

The following terms are used throughout the report:

- **SGSC:** This abbreviation is used to refer to the Australian Government funded *Smart Grid, Smart City* program testing smart grid technologies and their implementation in an Australian setting.
- **Customer Applications Program:** This was one of the programs involved in the SGSC trials. The two main trials undertaken as part of the Customer Applications Program were the electric vehicle trial and the customer trials (which are the focus of this report). The electric vehicle trial was conducted mainly with staff members of the SGSC Program. The scope of the surveys and this report is limited to the customer trials.
- **Trial participant group**: The trial participant group was the group of customers that participated in the SGSC trials in either the network customer trial or the retail customer trial.
- **Network customer trial:** The network customer trial participants trialled feedback technologies (such as online portals, home energy monitors, and home area networks), dynamic peak rebates and home energy audits. This trial investigated the effectiveness of products without changing existing retail electricity tariffs.
- **Retail customer trial:** The retail customer trial participants trialled products including dynamic peak pricing, seasonal time-of-use pricing, and a top up reward plan. This trial measured the effectiveness of alternative tariffs in combination with feedback technologies.
- **Control group:** The control group was a group designed to be representative of the same population group as the trial participant group. Households in the control group had smart meters installed at their houses but they did not participate in trialling a product. Comparisons between the control group and the trial participant group were used to isolate the impacts of products in the trial from “background” effects occurring in similar statistical populations.
- **Products:** A product within the SGSC program was defined as one of the following:
    - a smart grid technology (either one or more feedback technologies or a distributed energy technology) on its own
    - an SGSC pricing or incentive structure on its own (for a pricing product, a customer was moved to a new time-of-use tariff, while for an incentive product, the customer remains on their existing tariff but receives a financial incentive relating to their time of use of electricity)
    - a combination of an SGSC pricing or incentive structure with one or more feedback technologies
    - an education-based measure with no change to the customer's tariff and no feedback technologies offered.
- **Feedback Technology:** Customers were asked to trial smart grid technologies that provided feedback about their electricity consumption. These included an online portal, a home energy monitor, and a home area network (including smart plugs). All customers also had smart meters installed at their dwellings. As the

customer did not directly interact with this technology, this research does not involve questions about their smart meters.

- **Tariff:** A tariff is a pricing rate or structure for the sale and purchase of electricity. In the SGSC program each retail customer trialled one of a range of alternative tariffs. These tariffs were a top up reward plan, dynamic peak pricing, and a seasonal time-of-use tariff. Network customer trial participants remained on their existing tariff, which may have been either a fixed flat tariff, or a time-of-use tariff.
- **Peak event products:** Peak event products were designed to incentivise customers to reduce their electricity use during specified 'peak events', either by offering a discounted tariff throughout the year but a much higher tariff during peak events (i.e. dynamic peak pricing tariff) or by providing a rebate to customers based on how much their electricity use was reduced during a peak event. A 'peak event' was of limited duration (usually 4-6 hours) and was nominated ('called') by retailers or networks during times of high peak demand (e.g. particularly hot or cold days). Customers were notified in advance of the peak event, generally by SMS and were reminded to reduce their electricity use during the event. Customers were said to have 'participated' in the event if their electricity use was lower during the event than at other times.

2

Method

2.1 SURVEY DESIGN

Two separate surveys were carried out approximately six months apart. The first survey was conducted in September 2013 ("2013 survey") while the second was conducted in February/March 2014 ("2014 survey").

The first survey was designed by a working group including representatives from Government, Ausgrid (the network trial partner), EnergyAustralia (the retail trial partner) and appropriate members of the AEFI consortium. Where possible, questions were designed to keep the same format as questions used in other datasets such as those of the Australian Bureau of Statistics (ABS) and the NSW Independent Pricing and Regulatory Tribunal (IPART).

The survey included a number of questions aimed specifically at participants who had never activated their product,[6] or those who had since opted out of the trial. A control group survey was created using a small subset of the 2013 survey questions, focussed on household profiling and perspectives on energy issues.

For both trial participants and the control group, an SGSC smart meter was installed at the dwelling and the occupants were notified prior to the installation that they were to receive a new meter as part of the SGSC Program. They were told that they may be invited to trial a product or may be selected to be part of the control group. The trial participants then had contact with the SGSC Program through the process of signing up to and participating in the trial, whereas control group participants had no other direct contact with the SGSC Program.

As many of the participants, particularly within the Retail Trial, had a limited time trialling their products by the end of 2013, the Customer Applications trial was extended to run over the summer 2013–14.

Because of this, the 2014 survey was implemented to capitalise on the larger available pool of eligible participants (see Section 2.2.1 below) and to take account of the additional experiences of participants over the 2013–14 summer. The 2013 survey questions were used as the basis of the 2014 survey, with a small number of amendments to the wording of 2013 questions to improve clarity, plus the creation of a number of additional questions designed to capture more detailed information. An expanded version of the survey was created for respondents who had completed the 2013 survey, containing questions designed to capture any changes in perspectives in the six months since completing the first survey.

[6] This group also included respondents who had activated their product but had answered a filter question saying they had never used their product, or had only used it once or twice.

2.2 CONTACT AND DEPLOYMENT STRATEGY

2.2.1 Survey eligibility

The 2013 and 2014 surveys were aimed at participants of the Customer Applications Network and Retail product trials. Eligibility of trial participants was determined by the following criteria:

- **Product in scope:** participants had to have trialled one of the Customer Applications products indicated as "in scope" for the survey (see Section 1.2.4).
- **Product provisioned:** participants must have been provisioned with their product (i.e. did not reject their offer, did not withdraw prior to provisioning and were not excluded due to technical reasons).
- **Minimum product usage:** participants must have had their product provisioned for at least one month prior to each survey. In addition, participants on a peak event product (N4, N6, R6–R9) must have had at least one peak event called.

Figure 1 shows the eligibility of different categories of participants based on their stage in the trial, while Table 2 outlines the reasons for the inclusion or exclusion of each of these categories.

Figure 1: Determining eligibility of customers for survey

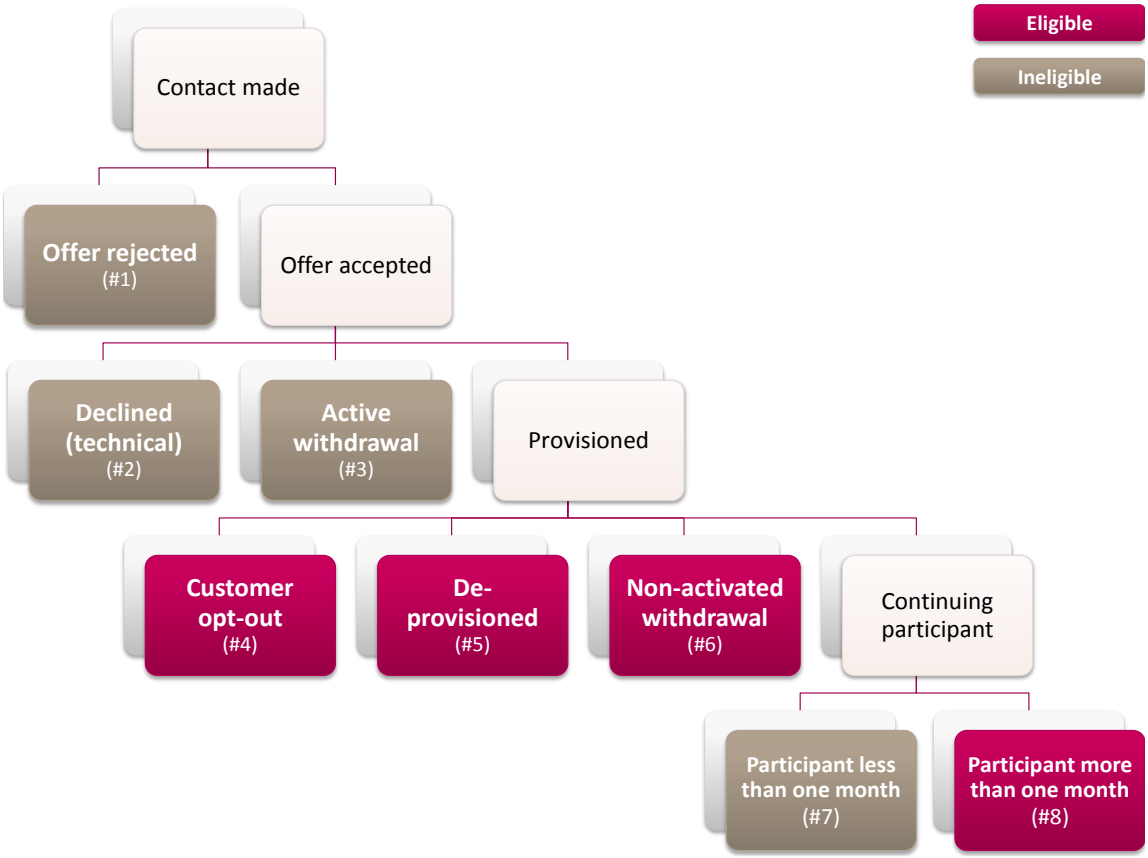


Table 2: Reasons for inclusion/exclusion of participant groups in the research

Category	Included	Explanation and Reasoning
1. Offer rejected	No	Information was already collected during sale attempt.
2. Declined (technical)	No	Reason for why these customers were in not the trial was technical only (circumstances beyond customer control).
3. Active withdrawal	No	Reasons for withdrawal already recorded by call centre and supplied to ISF in "Withdraw reason code" field.
4. Customer opt-out	**Yes**	Where the customer was fully provisioned and used the product for at least one month before opting out, it was still valuable to capture their experiences of using the product. Further, the survey included tailored questions for this category to confirm the reason for leaving, as recorded by the call centre.
5. De-provisioned	**Yes**	Where the customer was fully provisioned and officially trialled the product but subsequently left the trial, often because they moved out, or changed retailer away from EnergyAustralia. It was considered important to capture the experiences of those in this group who had used their product for more than one month.
6. Non-activated (passive) withdrawal	**Yes**	Customers previously contacted regarding reasons for not activating but were not thoroughly surveyed. Survey was tailored for this class and included only profiling and reasons for non-activation.
7. Continuing participant – less than one month	No	Participant needed to have had sufficient time with the product to form an opinion about its merits.
8. Continuing participant – longer than one month	**Yes**	This group constituted the bulk of the survey sample and provided the most information on participants' experiences of, and satisfaction with, their product.

2.2.2 Survey Deployment

A professional customer research company deployed the survey in the field, with management oversight from ISF and CenSoC. Participants completed the survey via phone using a Computer Assisted Telephone Interview (CATI) process or online via a unique link that was emailed to them.

In all cases, surveys were each piloted for one to two days before being deployed to the full sample. The 2013 survey ran for two-and-a-half weeks from 29 August to 16 September 2013, while the 2014 survey ran for seven weeks from 10 February to 31 March 2014.

For both the 2013 and 2014 survey, trial participants with email addresses were initially contacted via email and invited to undertake the online survey. Those participants who did not have an email address or did not respond to the initial email were then contacted by

phone and offered the opportunity of completing the survey via CATI.[7] For the 2014 survey, any customers without a valid email address or phone number where mailed a hard-copy invitation to participate in the survey.

For the 2013 survey, the control group were all contacted by phone initially,[8] and were given the opportunity to undertake the survey via CATI or at a later time using an online link.

For the 2013 survey, the incentive offered to respondents was entry into a prize draw to win a $3000 travel voucher or one of two iPads. In order to increase the sample size for the 2014 survey, individual incentives were offered for some categories of trial participants who were expected to have less motivation to complete the survey. The different categories of participants, along with the incentive they received, are shown in Table 3

Table 3: Incentives for 2014 survey respondents

Category	Incentive
New, active respondents (except where these fell into categories 4 or 5)	Entry into prize draw
Repeat respondents (who had completed the 2013 survey)	$20 shopping voucher
Opted-out respondents	$20 shopping voucher
Mail invite (for respondents with no email/phone contact)	$20 shopping voucher
Targeted products (respondents with products with small sample sizes)	$20 shopping voucher

[7] The trial participant group customers have already been involved in the SGSC program and so phone numbers and (in most cases) email addresses were available for this group.

[8] The control group customers had had no previous contact with the SGSC program (except for the notification of their new smart meter installation) and were not aware that they had been anonymously selected as part of the control group for the trial. However, all control group members were Ausgrid customers and so phone numbers for these customers were available (although not correct in 15–20% of cases).

2.3 RESPONSE RATES

The overall response rate figures for the 2014 survey are summarised in Table 4, while details on the proportions of different participant categories is displayed in Table 5. Deployment statistics for the 2013 survey are provided in Appendix 7.2.

Table 4: Overall response rates of 2014 survey

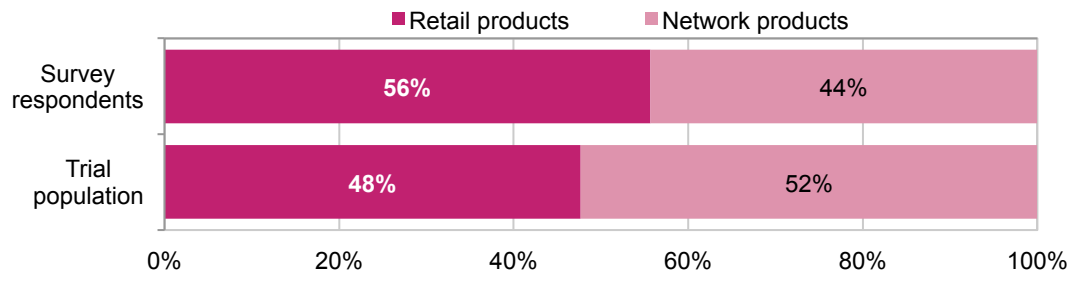
	#	%
Sample size	6947	
Completed survey (%)	**2518**	**36%**
Completed online	959	38%
Complete by phone	1559	62%
Unable to be completed in time (%)	454	7%
Unable to contact (%)	1804	26%
Refused (%)	1876	27%
Language difficulties (%)	114	2%
Other (%)	181	3%
Conversion rate of those who qualified and were contacted (%)		**52%**

Table 5: Detailed response rates of 2014 survey by participant category

Respondent category	Trial sample size	Survey sample size	Conversion rate
New, active respondents	63%	50%	27%
Repeat, active respondents	23%	39%	61%
New, opted out respondents	13%	9%	23%
Repeat, opted out respondents	2%	3%	35%
	100%	**100%**	

A slightly higher proportion of survey respondents trialled Retail products (56%) compared to Network products (44%) (Figure 2). This is opposite to the distribution of the overall trial population (48% Retail compared to 52% Network).

Figure 2: Survey sample by Network/Retail product selection



From Ausgrid CIS data.

Response rates across the 18 products varied substantially, both in the proportion of trial respondents who completed the survey ("% of product sample") [9] and the proportion that each product made up of the overall survey sample ("%of survey sample"). The products with the highest and lowest proportions of product sample and survey sample are indicated in dark pink and dark grey in Table 6.

Table 6: Response rates by product

Product	Trial product sample	Survey completes	% of product sample	% of survey sample
N1: SGSC Home Energy Online	1300	395	30%	16%
N2: SGSC Home Energy Monitor	596	131	22%	5%
N3: SGSC Home Energy Assessment	174	42	24%	2%
N4: SGSC Home Energy Rebate	670	239	36%	10%
N5: SGSC Home Energy Network + Home Energy Online	57	18	32%	1%
N6: SGSC Home Energy Rebate + Home Energy Monitor	629	222	35%	9%
N7: SGSC Home Energy Online + Home Energy Monitor	165	53	32%	2%
R1: BudgetSmart	84	26	31%	1%
R2: BudgetSmart with PowerSmart Monitor	536	243	45%	10%
R3: BudgetSmart with PowerSmart Online	249	93	37%	4%
R4: BudgetSmart with PowerSmart Online & Home Control	78	41	53%	2%
R6: PriceSmart	390	149	38%	6%
R7: PriceSmart with PowerSmart Monitor	992	460	46%	18%
R8: PriceSmart with PowerSmart Online	307	146	48%	6%
R9: PriceSmart with PowerSmart Online & Home Control	104	54	52%	2%
R10: SeasonSmart	155	45	29%	2%
R11: SeasonSmart with PowerSmart Monitor	271	89	33%	4%
R12: SeasonSmart with PowerSmart Online	121	53	44%	2%
Total	**6878**	**2499**	**36%**	**100%**

Note: Table excludes those with products N9 BlueGen Gas Fuel Cell (12 respondents) and N10 Redflow Storage System (7 respondents).

[9] Note that to assist with reaching minimum product sample sizes, individual incentives were offered for some products which halfway through the deployment time did not seem likely to reach the desired minimum product sample size of 50. These included: Products N3, N5, N7, N13, N17, N18 and N20.

2.4 ADDITIONAL SOURCES OF DATA

In addition to the 2014 survey data, data was also sourced from three main places:

- 2013 survey data
- Ausgrid customer data
- Frontier Economics savings estimates.

In addition, for a small number of questions, additional data was also sourced from other places to enable comparisons of results. For example, ABS data on NSW demographics was used in the profiling section.

2.4.1 2013 survey data

The 2013 survey was completed by 1,710 trial respondents, 994 (or 58%) of whom also completed the 2014 survey. For those 716 respondents who did not complete the 2014 survey, and where the questions were the same between two surveys, their answers were incorporated into the dataset alongside 2014 respondents. This increased the total sample size for 2014 analysis from 2,499 to 3,215.

2.4.2 Ausgrid customer data

Ausgrid provided data on survey respondents from their Customer Information System (CIS). This included contact details in order to deliver the survey, as well as some demographic data such as dwelling type, household income and appliance ownership. Much of this data was derived from the Customer Acquisition Application (CAA), which collected information on households when they signed up for the trial. In addition, Ausgrid provided data on the historical electricity consumption band of the household, obtained from Meter Data Repository (MDR). Through the report this source is referred to as 'Ausgrid CIS data'.

2.4.3 Frontier Economics savings estimates

Ausgrid provided Frontier Economics with trial and pre-trial energy consumption data (where available) for each respondent household. This included total energy consumption as well as consumption specifically during peak periods (2-8pm). Frontier then estimated the change in consumption (both overall and peak) attributable to the trial for each household, by adjusting for general trends in energy consumption observed in a control group.

For those respondents who trialled peak event products, Ausgrid provided Frontier with energy consumption data on peak event days. Frontier then constructed a model of each individual household's 'typical' behaviour on hot and cold days. By comparing each household's response during peak events to their typical behaviour, Frontier estimated the level of peak event savings for each household.

2.5 ANALYSIS OF RESULTS

The spread of responses to each survey question has been either graphically presented in a figure or described in the text. For key questions, various statistical tests were carried out on responses as described below.[10]

2.5.1 Household profiling

Profiling of the survey sample was undertaken to understand their demographic characteristics, appliance ownership patterns and perspectives on energy issues of those who completed the survey.[11] Responses to the household profiling questions and perspectives by trial respondents and the control group were statistically analysed to identify any differences between the two groups. Where differences were statistically significant, control group results were presented alongside trial participant responses for comparative purposes. Results of this analysis are presented in Section 3.

2.5.2 General survey analysis

Statistical analysis of general survey results was a combination of pre-determined tests for key questions or cases where particular results were expected, and spontaneous testing to confirm observable differences found during the presentation of results. The main types of analysis are outlined in Table 7, and results are presented in Section 4.

Table 7: Statistical analysis of 2014 survey questions

Demographic analysis	Statistical analysis was carried out on a short list of pre-determined questions, to determine any associations with the following demographic variables: language, income, home ownership status and historical electricity consumption. Where statistically significant associations were found, these were discussed below the analysis of the relevant survey question.
Between-groups analysis	Graphs were created for most questions based on the following groupings: • network trial respondents vs retail trial respondents • product Type (Pricing/ Incentive only vs. Technology only vs. Combination of pricing/technology) • pricing/Incentive type (Peak Rebate vs. PriceSmart vs. SeasonSmart vs. BudgetSmart) • feedback technology type (Portal only vs. Monitor only vs. Portal+HAN[12]) • product (by 18 individual products) Observable differences were then noted for statistical testing to determine

[10] Due to the extremely large number and array of questions, statistical testing was confined to testing for overall associations between the selected variables. Further post-hoc testing was not carried out to confirm the exact relationship between the different levels of the variables. Instead, the observable differences between levels were relied on where the overall association was significant. The data is available in the Information Clearing House (ICH) for others to do this level of analysis in the future if desired.

[11] Differences exist between the profiles of the participants in the Network and Retail trials, however in all cases results show the aggregate of the two trial groups.

[12] One product (N7) included a feedback technology bundle comprising the Portal and Monitor. For some questions, respondents were instructed to answer the question firstly for the portal and again for the Monitor. In other cases they answered for the bundle as a whole. Where their responses were split by technology, each response was included separately in the relevant technology group. Where the response was given for the bundle as a whole, due to the very small sample size of this grouping, responses were excluded from analysis by Technology Type.

	whether the differences were statistically significant.
Between-question analysis	Statistical analysis was carried out on a short list of pre-determined questions to determine whether there was any relationship between the responses to different questions.
Time-series analysis	The 2014 "repeat" survey included additional questions asking respondents who had earlier completed the 2013 survey about their own perceptions of the change in the 6 months between the two surveys.[13]

2.5.3 Product conclusions

In addition to the "between groups" analysis carried out for individual questions, a select group of key questions that could act as key success measures of the trial were identified. "Between-product-groups" analysis was then run on these questions to determine if there were any overall differences between the products trialled. These results are presented in Section 5.1.

2.5.4 Vulnerability analysis

Four groups were created from the sample for special analysis based on certain criteria that could render participants vulnerable to increased bills or time of use pricing. These groups were:

- Financially vulnerable households (i.e. low-income)
- Elderly households
- Households with children
- Households with high energy usage

Statistical tests were run on a set of demographic variables for each group to see whether (and if so, how) they differed from the overall survey sample, and then statistical tests were run for a select, pre-determined list of questions to see if statistically significant differences existed between the group and the rest of the survey sample. Only those questions that revealed statistically significant results were reported on. These results are presented in Section 5.2.

2.5.5 Actual vs perceived analysis

An area identified for further research following the 2013 survey was exploration of the similarities and differences between respondents' perceptions of their trial experiences compared to the data recorded on their electricity consumption during the trial.

[13] Asking for self-perceived changes over the six-month time period between the surveys was chosen as the approach, rather than comparisons of the responses given by the respondent for the two surveys. This is because the questions involved mostly use Likert-scale responses, which are subjective measures and do not lend themselves well to before and after comparisons over large periods of time. This is because individuals construct a new 'frame of reference' (i.e. assign meanings to the end points of the scale) each time they answer the question. Variations between the responses therefore often simply reflect the various differences in respondents' frames on the days they answer the survey, rather than changes in their attitudes or experiences over the period between the surveys. To test this, for a select group of pre-determined 'repeat' questions, the difference between the 2013 and 2014 responses was calculated for each repeat respondent and then coded as to the direction (e.g. increased, no change, decreased), and in some cases, the extent (e.g. +2, +1, 0, -1, -2 etc.) of the change. In all cases, graphing these changes resulted in data 'normally' (i.e. bell curve) or evenly distributed across the various change options. These results are therefore not presented in this report.

This was therefore included in the scope for the 2014 survey. Survey questions that would benefit from this additional level of analysis were identified, and analysis was undertaken which combined the survey responses with the savings estimates provided by Frontier. These results are presented in Section 5.3.

2.6 REPORTING OF RESULTS

The overall results of the majority of the 2014 survey questions[14] are presented, either in the body of this report or, if considered less important, in the appendix. Any additional 'general' analysis (see Table 7) that was run on a question is only reported if it was found to be statistically significant.

All survey results presented in this report disclose the full 2014 survey question answered by respondents (or the alternative data source) in italicised notes underneath the graph or table. To give three examples: *Q.B3* refers to 2014 survey question number B3; *2013 CQ.B2* refers to the 2013 control survey question B2, while *CIS* refers to the customer data provided by Ausgrid (see Section 2.4.2).

The number of respondents who answered a particular question is indicated by the notation *n=XXX.* For example, *n=3378* indicates that a total of 3,378 responses are represented in the graph. Where a graph shows sub-groups, such as Retail and Network trial, or Technology type, the number of respondents within each sub-group is also indicated in the graph.

Statistical analysis was not undertaken on all questions. For questions where it was undertaken, test results are only reported if statistically significant. The result is noted as statistically significant in the text, and details of the statistical test and p value are given in a corresponding footnote.

As discussed above in Section 2.5, the remainder of this report is constructed as shown in Table 8.

Table 8: Structure of this report

Chapter	Description
3. Profiling	Presentation and discussion of the demographics and other household attributes of the survey sample.
4. Survey Results	Presentation and discussion of the results to all survey questions.
5. Overarching Analysis	Analysis that looks at trends across various survey questions, including: • Overarching product conclusions • Vulnerability analysis • Comparison of perceptions and experiences with actual savings.
6. Conclusions and Recommendations	A brief summary of the main conclusions from completing the survey.

[14] Following the 2013 survey, a report was developed presenting the results. That initial version of the report was replaced with this document.

3

Respondent Profile

This chapter presents the demographic characteristics, appliance ownership patterns and perspectives on energy issues of the survey sample. Differences exist between the profiles of the participants in the Network and Retail trials, however in all cases results show the aggregate of the two trial groups. As discussed in Section 2.5, responses to the household profiling questions and perspectives by trial respondents and the control group were statistically analysed to identify any differences between the two groups. Where differences were statistically significant, control group results were presented alongside trial participant responses for comparative purposes.

3.1 HOUSEHOLD PROFILING

The purpose of this section is to describe the profile of trial participant households in terms of demographics and appliance ownership and behaviours. In doing so, it aims to achieve two goals:

1. **Provide analytical context:** This section provides the reader with context surrounding the profile of SGSC trial respondents. While this information is not necessarily specifically relevant to the interpretation of results contained in Sections 4 and 5 of the report:
    a. demographic characteristics may have a large bearing on energy consumption or a household's ability to take up product offers (e.g. household size or income)
    b. appliance ownership information may inform the interpretation of certain responses (e.g. a lower than expected ownership of air conditioning may help to explain a lower response to 'ability to shift demand on hot days').
2. **Identify differences between trial respondents and the broader population:** This section identifies where the demographics and appliance ownership of trial participants (or more accurately, those participants in the trial that responded to the survey) differ from the broader population. These differences may be due to geographical or logistical factors associated with the rollout of the trial. This background information is intended to help the reader to interpret the results, noting that demographic differences *may*, or *may not*, skew responses to certain survey questions.

The first goal is achieved by presenting the main trial participant responses to the demographic and appliance ownership questions. The second goal is achieved by comparing the responses of trial participant respondents (labelled 'trial' in the graphs below) with the control group (labelled 'control' in the graphs below). Only some responses differ between the trial participant and control groups. The control group result is only presented alongside the trial participant group when the difference between the two groups was statistically significant. That is, if only the trial participant group data is shown, this implies that no statistically significant difference was found between the trial respondents and the control group.

In cases where other NSW data was available, this is also presented alongside the trial participant and control groups to enable a comparison to the state average.

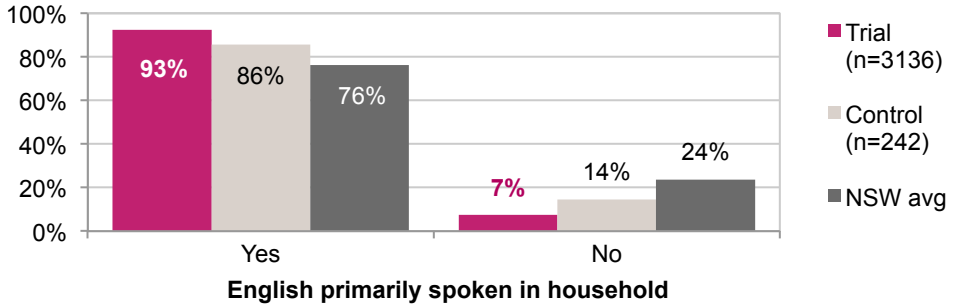
3.1.1 Demographics

3.1.1.1 Primary language spoken

The large majority (93%) of respondents spoke English as their primary language at home (Figure 3). This was higher than both control group respondents (86%), and the NSW

average (76%). This difference between trial participant respondents and the control group was statistically significant.[15]

Figure 3: Proportion of households speaking English as the primary language



From responses to: 'Is English the primary language spoken at home?' (Q.B3/2013: CQ.B2; n=3378) NSW averages from ABS 2011 Census, Basic Community Profile NSW, B13 Language Spoken at Home by Sex. Percentages for each group sum to 100%.

The over-representation of those with English as a primary language in the survey sample means that if respondents that were less fluent in English responded differently to trialled SGSC products compared to primary English speakers, then some results shown in this survey may not be able to be generalised to the broader energy consuming community.

When we expected there might be differences in survey responses according to primary language (such as engagement with information provided on feedback devices), we tested them for statistical significance and highlighted the results in the commentary. If there was no statistically significant difference between primary English speakers and others, then the 'skewing' of the trial survey sample towards primary English speakers will have no bearing on the results. It would then be possible to apply the results of such responses to a broader population that differs in terms of primary language.

Similar interpretations of the implications of any 'skewing' of the trial participant population characteristics can be applied to other demographic or appliance ownership factors in the remainder of this section and in Section 3.1.2.

3.1.1.2 Dwelling Type

The large majority (85%) of trial participant respondents lived in houses, with 13% living in units and just 2% in semi-detached, terraces or townhouses (Figure 4).

Substantial differences were apparent when comparing this spread of dwelling types with the control group and the NSW averages.[16] While still the majority, only 70% of control respondents and NSW residents reside in detached dwellings (houses).The difference between control and trial groups was statistically significant,[17] and may reflect factors such as:

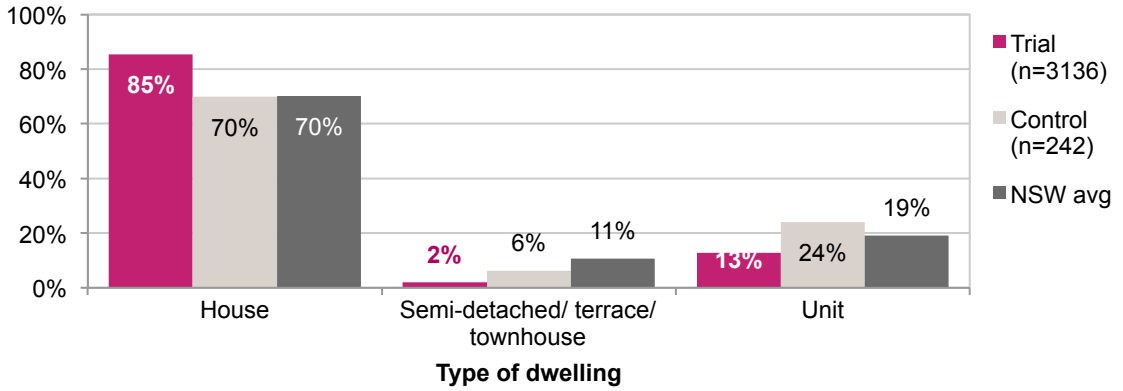
- The door-to-door recruitment method used for many of the trials may have favoured residential houses, as face-to-face contact between recruiter and householder was more likely in this housing type.
- A geographical bias in the recruitment may have favoured areas of detached houses.

[15] Fisher's Exact Test, p<0.001

[16] Australian Bureau of Statistics, 2011 Census Community Profiles, www.censusdata.abs.gov.au

[17] Pearson's Chi-square Test, p<0.001

Figure 4: Proportion of households by dwelling type



From responses to: 'Which of the following best describes where you live?' (CIS/2013 CQ.B3; n=3377) NSW averages from ABS 2011 Census, Basic Community Profile NSW, B31 Dwelling Structure. Percentages for each group sum to 100%.

As discussed above, where results presented in Section 4 differ statistically significantly according to the respondent's dwelling type, these are highlighted in the analysis, and such results could not be considered to be representative of the broader NSW situation.

3.1.1.3 Home ownership status

Overall, 79% of trial participant respondents owned the home they lived in, either outright (40% of total population) or mortgaged (39%) (Figure 5). A further 15% privately rented their homes, while about 2% rented with government assistance and about 2% lived in public housing).

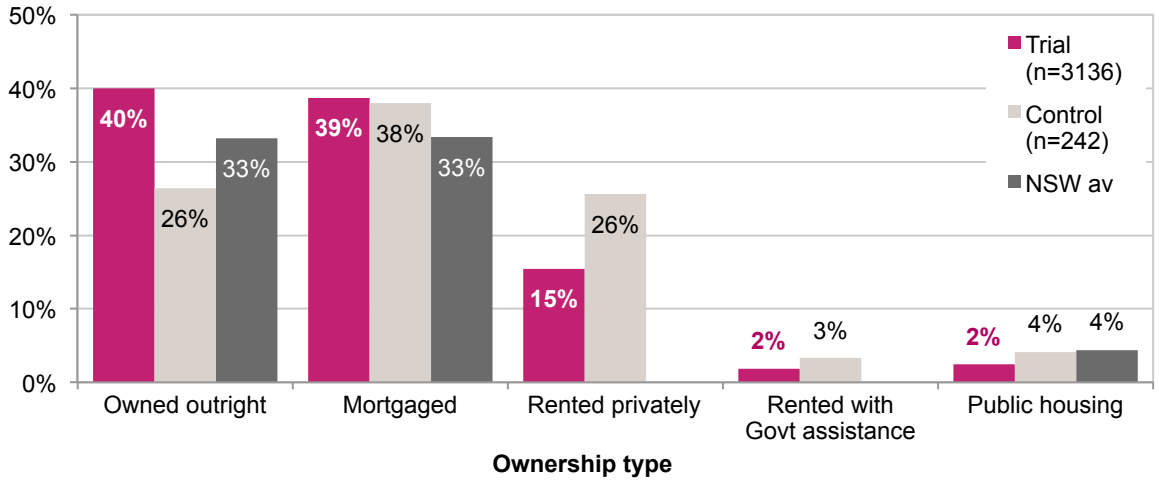
The trial group had somewhat higher levels of outright home ownership than the control group (26%) and NSW average (33%) and lower levels of private rentals than the control group (26%) and NSW average (not shown[18]).

The distribution of home ownership status was found to be statistically different between trial and control groups,[19] which may be linked to the trial sample bias of detached house type (from Figure 4 above). This difference should be noted when interpreting results relating to financial vulnerability touched on by other questions, as it was possible that according to some measures, trial participant respondents may have contained a lower proportion of vulnerable consumers (see for example, Section 3.1.1.7 and Section 5.2).

[18] NSW average is 26% for all rentals, which compares to 17% for trial respondents (15% rented privately and 2% rented with government assistance).

[19] Pearson's Chi-Square Test, $p<0.001$.

Figure 5: Type of household ownership of respondents

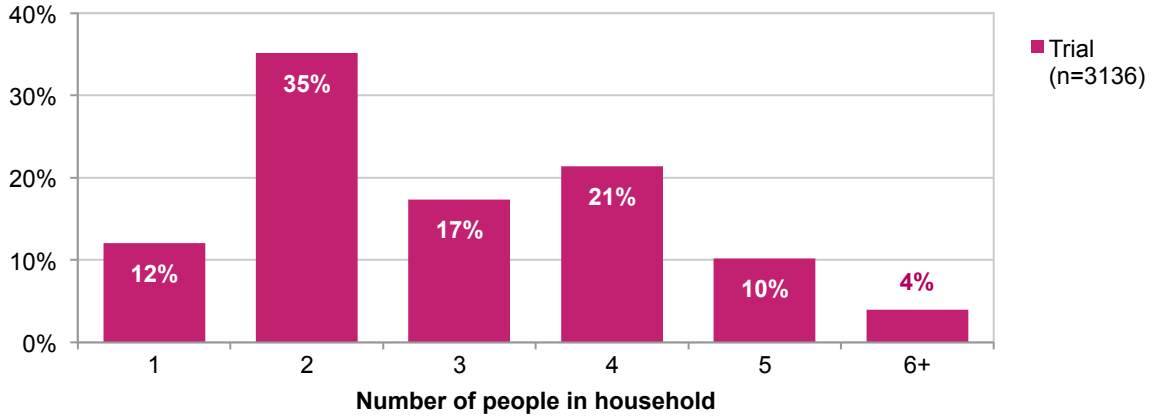


From responses to: 'Which of the following best describes your household's ownership of the house?' (Q.B4/2013: CQ.B4; n=3378) NSW averages from ABS 2011 Census, Basic Community Profile NSW, B32 Tenure and Landlord Type by Dwelling Structure. NSW average for all "Rented" is 26% – unable to split between 'Rented privately' and 'Rented with Govt. assistance'. Responses of "Other" or "Prefer not to say" not shown, but equalled 2% for trial and control and 3% for NSW, therefore percentages do not quite sum to 100%.

3.1.1.4 Household size

The average size of trial participant respondent households was 2.8 people. The largest proportion of respondents came from two-person households (35%), followed by four-person and then three-person households (21% and 17%) respectively (Figure 6). Differences between the trial and control groups were not statistically significant.

Figure 6: Household size distribution



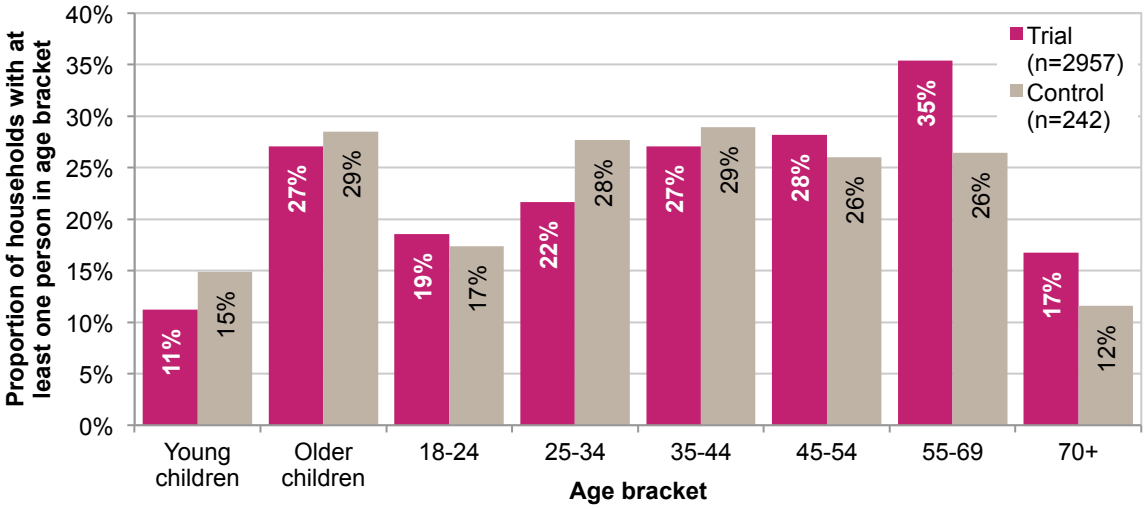
Calculated From responses to: 'How many people in your household fit into each of the following age groups?' (Q.B2/2013: CQ.B1; n=3378). Percentages sum to 100%.

3.1.1.5 Household ages

Respondent households had a slightly older age profile than the control group, with more households containing adults aged 55–69 than any other adult age bracket, followed by adults aged 35–44 and 45–54 (Figure 7). About a quarter of respondent households had older children while only 11% had young children.

A higher proportion of trial households had older adults compared to the control group, however the complexity of age categories prevented statistical testing of these differences. The older profile in trial respondent households may be linked to differences between trial and control group for home ownership status (Section 3.1.1.3) and dwelling type (Section 3.1.1.2).

Figure 7: Age distribution in households[20]



From responses to: 'How many people in your household fit into each of the following age groups?' (TQ.B2/CQ.B1; n=1880) Percentages indicate the number of households containing at least one person of that age group, and therefore do not sum to 100%.

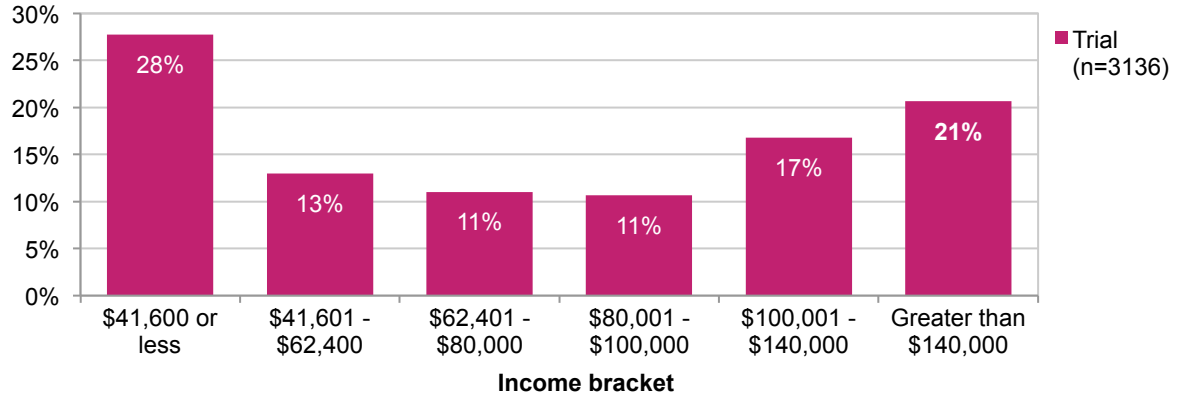
3.1.1.6 Household income

Two-thirds of trial respondents estimated their gross (pre-tax) combined household income for the survey. Of these, the largest proportions of trial respondents fell at either end of the spectrum, with 28% in the lowest income bracket of $41,600 or less per annum and 38% of households earning over $100,000 or more per annum (Figure 8). The remaining 34% fell between these two figures. No statistically significant differences were found in household income between trial respondents and the control group. While NSW averages are not shown in the graph, the survey sample had a similar proportion of households in the lowest income bracket compared to the NSW average, but a higher proportion of households with income over $100,000 compared to the NSW average (38% versus 27%).[21]

[20] Note this excludes 142 respondents who preferred not to provide the age breakdown of the household. These respondent households are therefore excluded from later vulnerability analysis based on age, such as elderly households or households with children.

[21] NSW averages from ABS 2011 Census, Basic Community Profile NSW, B28 Total Household Income (weekly). NB: Proportion of households with income under $41,600 in trial respondents is similar to NSW average of 30%. ABS used different cut-off points for the middle income brackets to those used in the questionnaire (ABS brackets: ($41,601–$62,400; $62,401–$80,000; $80,001–$100,000).

Figure 8: Gross (pre-tax) household income distribution



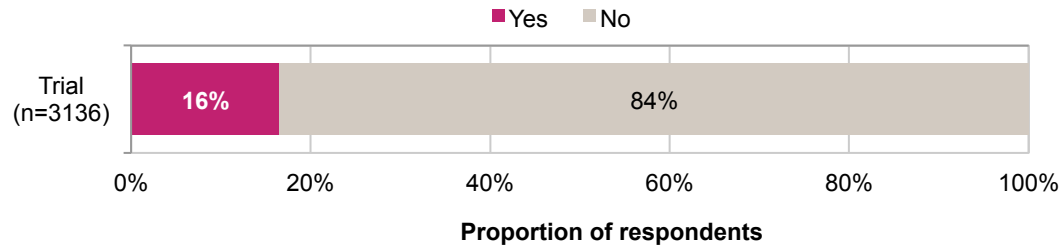
From responses to: 'What is your gross (pre-tax) annual household income?' (Q.B10/2013: CQ.B15; n=3378)
NB. Response categories taken from the Trial Customer Application Acquisition (CIS) income question, with additional categories added in the upper ranges.

3.1.1.7 Energy vulnerability

As a measure of energy vulnerability, respondents were asked whether they had felt financially unable to pay their energy bills at any stage in the 12 months preceding the survey ('energy bill vulnerability'). (Participants were also asked what appliances they would be unable or unwilling to shift outside of a peak window if peak prices were double the rates at other times ('time-of-use vulnerability') – this is discussed separately in Section 3.1.2.3).

Sixteen per cent of trial respondents indicated having experienced energy bill vulnerability (Figure 9). Differences between the trial and control groups were not statistically significant

Figure 9: Energy bill vulnerability (households unable to pay energy bills within past year)



From responses to: 'Have you felt financially unable to pay your energy bills at any stage over the last 12 months?' (Q.B8/2013: CQ.B13; n=3378)

3.1.2 Appliance ownership and behaviours

As part of the trial sign up, trial participants were asked a range of questions on appliance ownership and behaviours, as part of the process of establishing whether any of these factors can be used as key 'markers' to help to group or explain households with similar consumption. The control group was also asked these questions as part of the ISF survey, to provide Ausgrid with information to assess whether demographic bias in the trial participant group was correlated with bias in appliance ownership and behaviours.

In this section, statistical analysis was only conducted on the differences between trial participant respondents and the control group in a limited number of circumstances, where

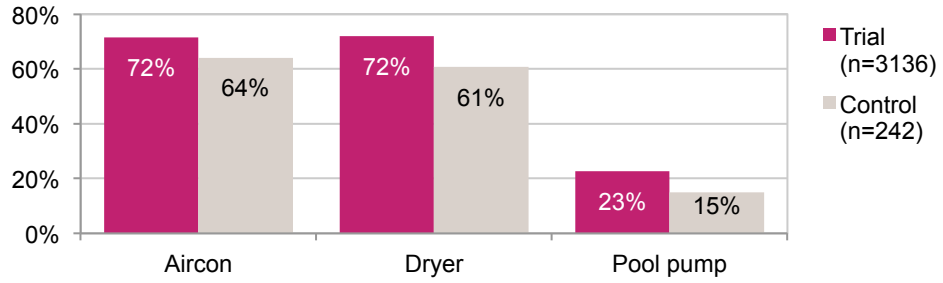
this is clearly stated. This was a prioritisation of effort given the intensity of statistical testing, the large number of questions, and the fact that this data was primarily obtained for providing to Ausgrid in raw form.

3.1.2.1 Ownership of high-electricity using appliances

Ownership of large energy using appliances is shown in Figure 10 below. Almost three-quarters of trial participant respondents reported having air conditioning installed.[22] Similarly, almost three-quarters of respondents had clothes dryers[23] and almost one-quarter of respondents reported having a pool pump.

Comparison of trial participant and control group data shows that ownership of the three high-energy using appliances was somewhat higher for the trial participant group than for the control group. This difference was found to be statistically significant in all cases.[24] This could plausibly be related to a greater representation of single detached dwellings in the trial participant group.[25]

Figure 10: Proportion of respondents with high-electricity using appliances



From responses to: 'Do you have any of the following? You may choose more than one appliance.' (CIS/2013 CQ.B6; n=3377)

Of those trial participant respondents who reported having and using their dryers,[26] over two-thirds (69%) only used them once a month or less (Figure 11).

Slight differences in dryer usage were observable between trial participant respondents and the control group, with trial respondents generally using their dryers less frequently.

[22] The 2013 survey data indicated that 70% of these were wall mounted/split systems and 26% ducted systems.

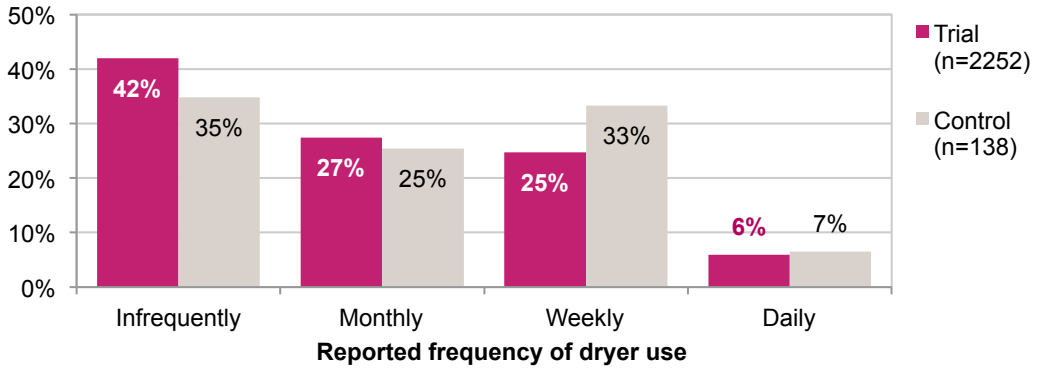
[23] Trial participant group dryer ownership was calculated by using reported frequency of dryer use, as participants were not explicitly asked whether they owned a dryer during the trial signup process as the focus was on energy use rather than appliance ownership. It is thus likely that the trial group results may understate dryer ownership, as the usage level 'never' was recorded as not owning a dryer.

[24] Fisher's Exact Test. Pool pump: $p=0.004$, dryer: $p<0.001$, air conditioner: $p=0.015$.

[25] This correlation was not statistically tested.

[26] Of those in the control group who had a dryer, 6% reported 'never' using it. The corresponding figure for the trial participant group was not available as it is likely that the usage level 'never' incorrectly includes those that do not own dryers (as per the discussion above).

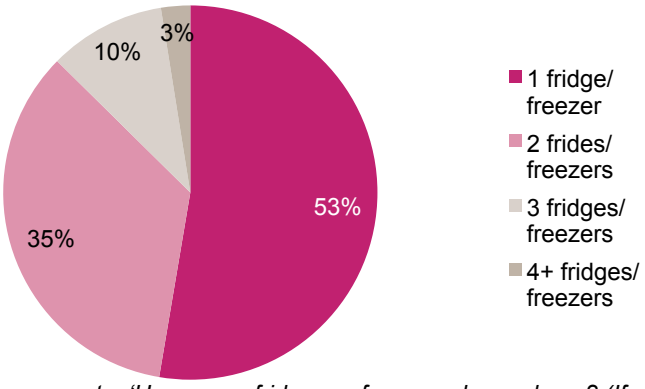
Figure 11: Frequency of dryer usage



From responses to: 'How often do you use your clothes dryer? Daily; A couple of times a week, A few times a month, Very infrequently, Never.' (CIS/2013 CQ.B6c; n=3377) NB. Graph excludes 467 people who answered 'Never'. Responses sum to 100%.

Approximately half of trial participant respondents owned one combined fridge/freezer, approximately a third (34%) had two fridges/freezers[27] and one in 10 households had three (Figure 12). Results were similar between trial participant respondents and the control group.

Figure 12: Number of fridges/freezers per trial respondent household



From responses to: 'How many fridges or freezers do you have? (If you own a combined refrigerator/freezer please count as one. If you have a stand-alone fridge and stand-alone freezer, please count as two.)' (CIS/2013 CQ.B7; n=3377)

3.1.2.2 Ownership of electricity-saving systems/appliances

This section shows household profiling information relating to systems or appliances that reduce demand for electricity through fuel switching (from electricity to solar radiation or gas).

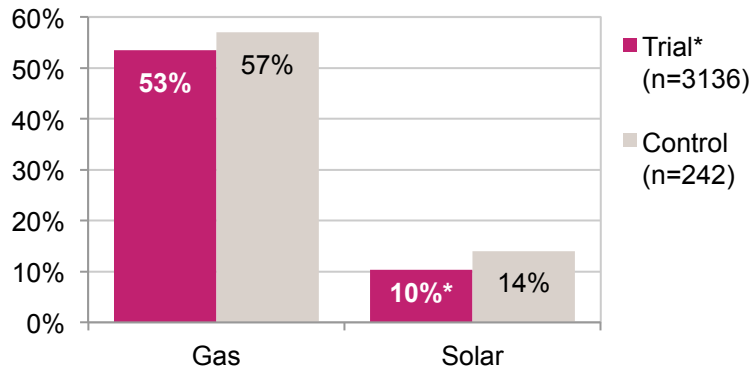
Approximately half (49%) of all trial participant respondents reported having a gas connection in their home, while 10% of trial participant respondents had solar (rooftop solar PV and/or solar hot water)[28] (Figure 13). These figures were both slightly lower than the control group (57% for gas and 14% for solar). The difference in solar is counter

[27] Note that this could be either one standalone fridge and one standalone freezer, a combined fridge/freezer and a second fridge, or two combined fridge/freezers.

[28] Note this figure only refers to participants in the Network product trials, as the retail product trials screened out households with solar as part of the selection process. Retail trial participants were therefore excluded from the calculation of the percentage to avoid skewing the results.

intuitive given the higher proportion of units and semi-detached dwellings in the control group, which likely have less available roof space for solar power or hot water.[29]

Figure 13: Proportion of respondents with energy saving technologies/appliances

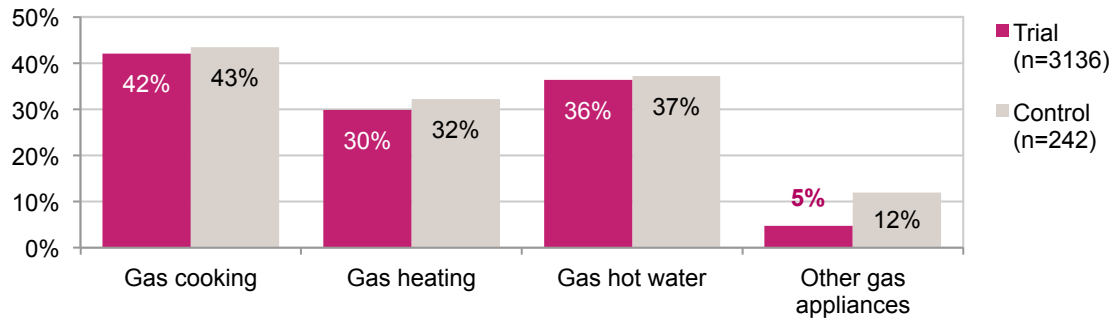


** Trial participant percentage for solar is only for respondents who trialled Network products, as the Retail trials purposefully screened out households with solar power.*

Figures were aggregated from responses to the following questions: "Regarding gas supply, do you have any of the following?" and for the control group, "Do you have any of the following? Solar hot water, Solar power…' (CIS/2013 CQ.B6, Gas n=1956, Solar n=1935).

Of those trial participant respondents that reported having a gas connection, on average they most commonly used it for cooking (42%), followed by hot water (36%) and then space-heating (30%) (Figure 14). There were no notable differences between the control and trial participant groups.

Figure 14: Proportion of respondents with different uses of gas



From responses to: 'Regarding gas supply, do you have any of the following?' (CIS/2013 CQ.B5; n=3378) NB. Respondents were allowed to select more than one category, therefore percentages do not sum to 100%.

3.1.2.3 Electricity consumption and effort to save energy

Just under half (44%) of trial participant respondents were classified[30] as 'Low' energy users upon signing up to the trial, with a third classified as 'Medium' and a quarter as

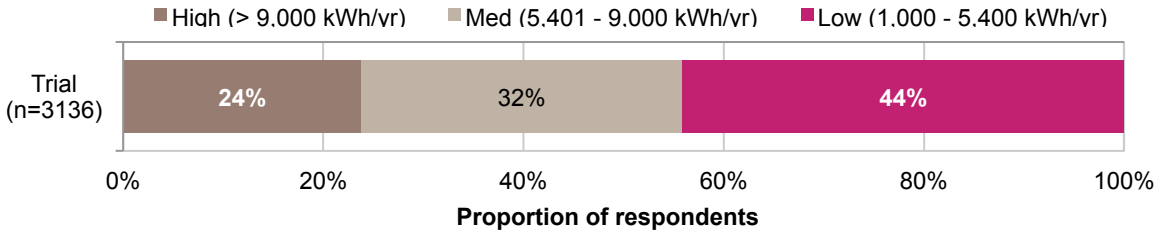
[29] Trial CIS data was captured at the time participant signed up to the trial, while control data was captured during the survey, between 6-18 months later, allowing more time for solar power installations. However this factor was considered unlikely to be a significant influence.

[30] Upon joining the trial, households were classified by Ausgrid as either Low (1,000 - 5,400 kWh/year), Medium (5,401 - 9,000 kWh/year), or High (9,000 kWh/year) energy consumers, based on metered data from the 12 months prior to signing up to the trial. Customers using less than 1,000 kWh/year were excluded from both control and trial samples. This was based on the assumption that households at this consumption level were likely to be unoccupied for all or a large part of the year.

'High' (Figure 15). Differences between trial participant respondents and the control group were not statistically significant.

This is slightly counter intuitive, given that the results shown earlier in Figure 10 indicate that trial respondents had statistically significantly greater ownership of high energy-using appliances than the control group, and fewer gas connections. This leads to an expectation of higher energy use for the trial participant group compared to the control group. While this may lead to the suggestion of some degree of self-selection bias in the trial participant group (those that were likely to put more effort into saving energy elect to sign up to the trial), this is not supported by the finding shown in Figure 16 below.

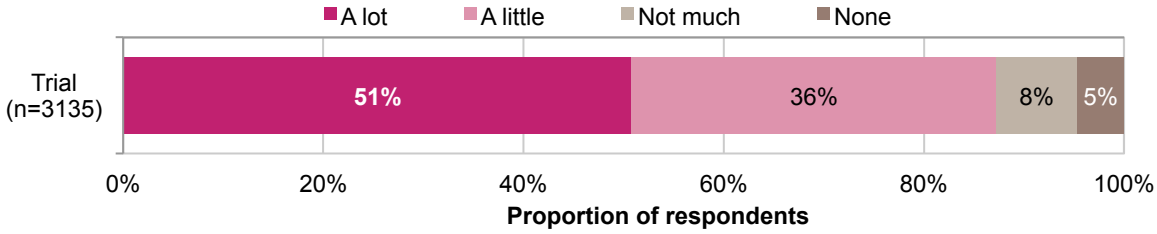
Figure 15: Historical level of household electricity use



From Ausgrid CIS data (n=3377)

When asked about the level of effort they devoted to reducing electricity use. Half (51%) of all trial participant respondents reported devoting "a lot" of effort to saving energy, while just over another third (36%) devoted "a little" effort (Figure 16). Only 13% of trial participant respondents reported making not much or no effort to reduce their electricity consumption. There was little noticeable difference between trial respondent and control groups and the difference was not statistically significant.

Figure 16: Self-reported level of effort to save energy

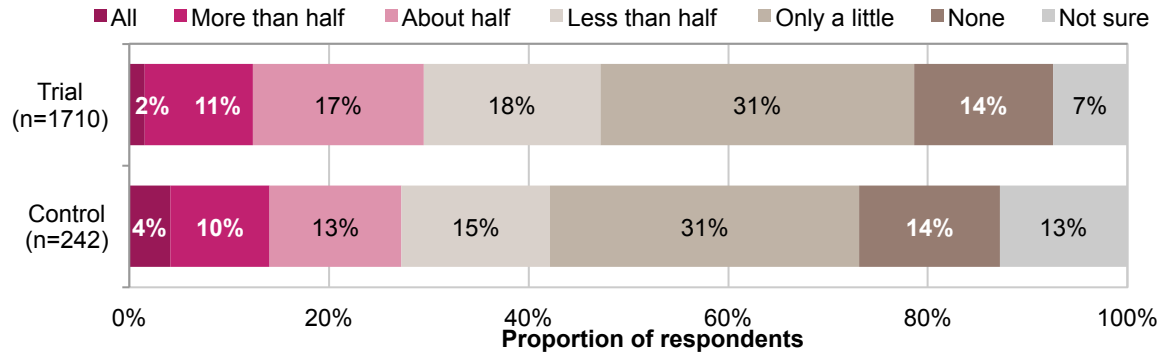


From responses to: 'How much effort do you devote to reducing your electricity use?' (CIS/2013 CQ.B8; n=3377)

The relationship between "effort to save energy" and historical energy consumption was investigated to determine if there was a relationship between consumption and conservation effort, however no obvious relationship was found.

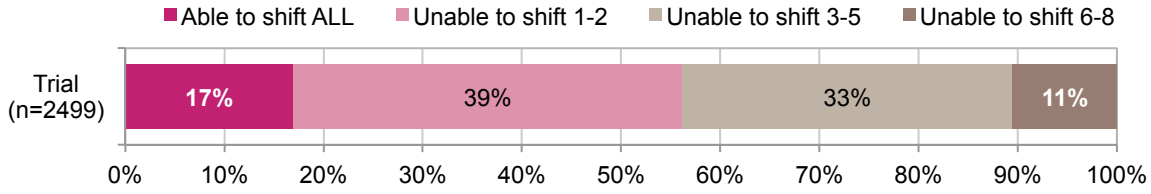
To determine the degree of discretion households felt they had to shift their electricity usage in response to time-of-use pricing, households in the 2013 survey were asked how much of their usage they felt they could shift. The majority of respondents to the 2013 survey estimated that they would only be able to shift less than half of their peak energy use (Figure 17). In the 2014 survey, more detailed information was requested. About 1 in 5 (17%) respondents thought they could shift all appliances, and another 2 in 5 respondents (39%) were only unable or unwilling to shift one to two appliances (Figure 18).

Figure 17: Perception of electricity able to be shifted outside of peak



From responses to: 'If electricity was more expensive from 2-8pm on week days but cheaper at other times, how much of your usual electricity usage during this period would you be able to shift to other times of day?' (2013 TQ.B9/CQ.B14; n=1952) 2013 respondents only.

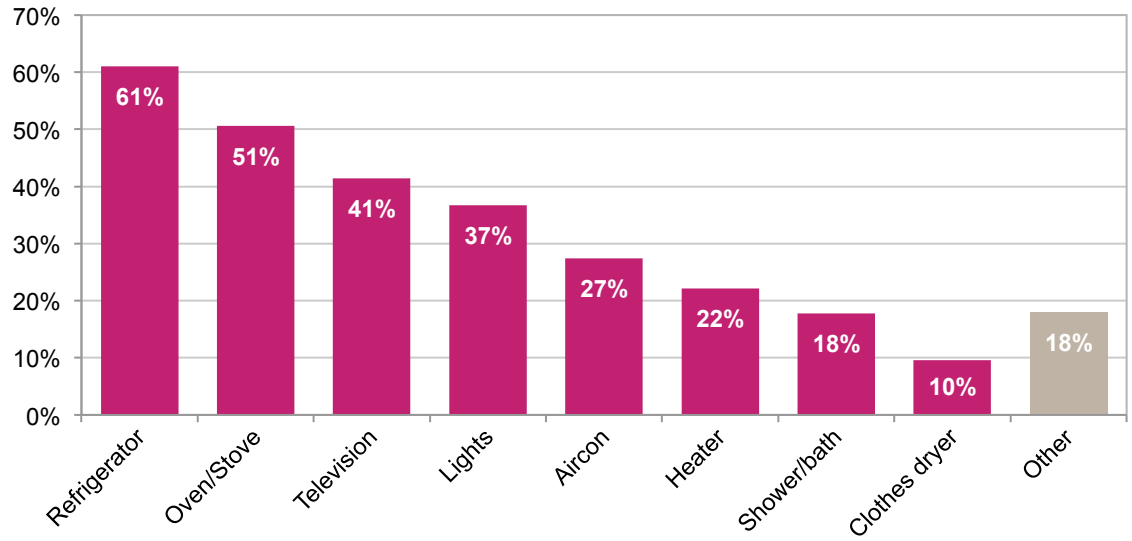
Figure 18: Perception of number of appliances able to be shifted outside of peak



From responses to: 'For which appliances would you be UNABLE or UNWILLING to shift your use to outside of 2-8pm? You may choose more than one option' (Q.B9a, n=2499) 2014 respondents only.

When stating which appliances they felt they had the least discretion in shifting, 3 out of 5 respondents noted the refrigerator, followed by the oven, television and lights (Figure 19). Interestingly, only around a quarter of respondents felt unable or unwilling to shift their use of home heating or cooling devices, which contribute strongly to residential demand during peak periods. This suggests the potential for an effective demand-side response.

Figure 19: Appliances unable to be shifted outside of peak



From responses to: 'For which appliances would you be UNABLE or UNWILLING to shift your use to outside of 2-8pm? You may choose more than one option.' (Q.B9a, n=2499)

3.2 PERSPECTIVES ON ENERGY ISSUES

This section presents household perspectives on energy issues, rather than household demographic or energy use characteristics and includes comparisons of trial participant respondents with the control group. It presents responses to survey questions that may help to guide decision-makers in targeting smart grid products and services to best match consumer preferences and ameliorate smart grid concerns. The data includes the importance households place on different factors relating to electricity supply, preferences for the types of energy services and products, the levels of trust of different organisations regarding the use of smart grid data, and the roles of different stakeholders in delivering smart grid education and awareness programs.

Results are generally shown for the trial participant group as a whole. Where differences exist between trial respondents and the control group, or between trial respondents on the Network-led trials and those on the Retailer-led trials, these are shown and discussed.

3.2.1 Electricity supply priorities

Respondents were asked to rate the following factors according to their level of importance:

- maintaining a reliable supply of electricity
- cost of electricity bills
- safety concerns in regard to smart meters
- having access to information about their electricity use at the time you are using it
- receiving electricity supplied from renewable or lower greenhouse gas emission sources
- protecting the privacy of their energy consumption data.

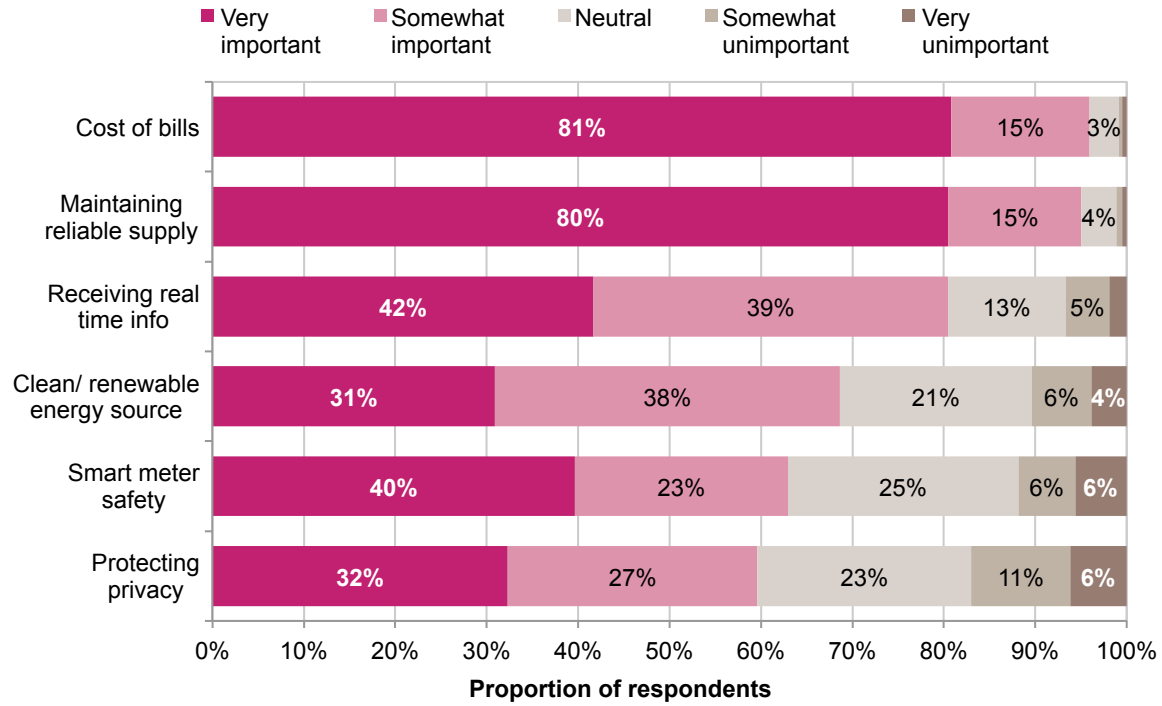
Trial participant respondents generally considered all six issues listed in the survey to be important, with the most respondents rating each issue as Very or Somewhat Important (Figure 20).

'Cost of bills' and 'Maintaining a reliable supply' were rated equal-highest in the list of the most important issues, with over 95% or respondents rating them as either very or somewhat important. These two factors are in fact in direct competition, in that to deliver higher and higher reliability of supply (with the probability of outage nearing zero) becomes infinitely more expensive. The equal priority placed on these competing outcomes suggests the need for a more nuanced examination of the trade-offs between the two issues. This would require dedicated choice modelling research, and ideally an ensuing public discussion regarding the acceptable bill impacts of reliability standards.

Receiving real-time information was rated as the next-most important issue (81% 'very' or 'somewhat' important). The final three issues (receiving electricity supplied from cleaner sources, smart meter safety and protecting privacy) all rated similarly at approximately 60 to 70% 'very' or 'somewhat' important. Interestingly, while smart meter safety ranked just below clean/renewable energy sources in overall importance, a noticeably higher proportion considered this issue 'very' important compared to clean/renewable energy sources and protecting privacy. Whether this indicates a specific awareness of smart meter safety concerns, or a default preference for the importance of 'safety' in general is unclear.

There were no statistically significant differences between trial participant respondents and the control group.

Figure 20: Importance placed on different priorities relating to electricity supply



From responses to: 'Thinking about the supply of electricity to your household, please rate the level of importance you place on the following issues: Maintaining a reliable supply of electricity (i.e. little or no interruption to the power supply); Cost of electricity bills; Safety concerns in regard to smart meters; Having access to information about your electricity use at the time you are using it; Receiving electricity supplied from renewable or lower greenhouse gas emission sources; Protecting the privacy of your energy consumption data' (Q.B5/2013: CQ.B10; n=2347)

The 2014 survey specifically interrogated the importance of financial versus environmental drivers by asking trial respondents to choose between statements regarding controlling the cost of their electricity bill, and controlling the environmental impacts of their electricity. Four in five trial respondents selected 'controlling the cost of their electricity bill', compared to 1 in 5 who selected 'controlling the environmental impacts of their electricity bill'.

3.2.2 Reason for engaging with trial

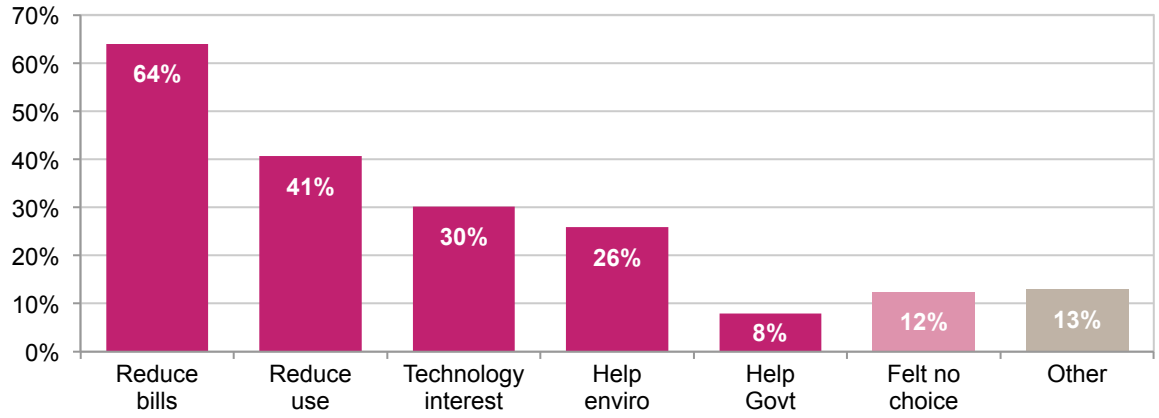
Respondents were asked why they decided to sign up to the trial, both to help inform future trial design and marketing, and to get an insight into desired outcomes. As shown in Figure 21, trial respondents most commonly reported a desire to reduce electricity bills as their reason for participating in the trials (64%). Other important drivers which encouraged people to participate in the trials were: reducing electricity use (41%), new technologies (30%) and helping the environment (26%). Around 1 in 10 trial participant respondents participated in the trial as they felt they had no choice, which should be noted for future trials in regards to the sales pitch put to householders by door knockers.

Those reasons given by those who answered "Other" included the following:

1. To learn about electricity and appliance energy usage more generally.
2. Because they knew other people who were participating, or because they thought 'everyone' was doing it.

3. Just because they were asked, or because they were convinced by the doorknocker but didn't necessarily have a specific reason.

Figure 21: Motivation for households to participate in trial



From responses to: 'Why did you choose to participate in this trial? You may choose more than one option.' (Q.A2; n=2105) NB. Respondents were allowed to select more than one category, therefore percentages do not total 100%.

To interrogate trial participant respondents' desires for energy saving technologies that inform and allow consumer choice, versus automated "set and forget" type technologies, respondents were asked to directly choose between 'wanting products that helped understand electricity use' and 'wanting products that helped automatically reduce electricity use'.[31] The results were very evenly split with 52% preferring automated reductions and 48% preferring products that enabled them to better understand and manage their use.

3.2.3 Comfort over sharing of electricity data

The issue of customer concern over the privacy of, and access to, electricity consumption data was touched on in Section 3.2.1. To further investigate this issue, we asked respondents to rate their level of comfort about the sharing of their data with different government, education and industry organisations (Figure 22).

Trial participant respondents were most comfortable with their existing retailers and networks accessing their data (69% and 65% respectively were either comfortable or very comfortable), which is unsurprising given that both these parties already have access to this data.

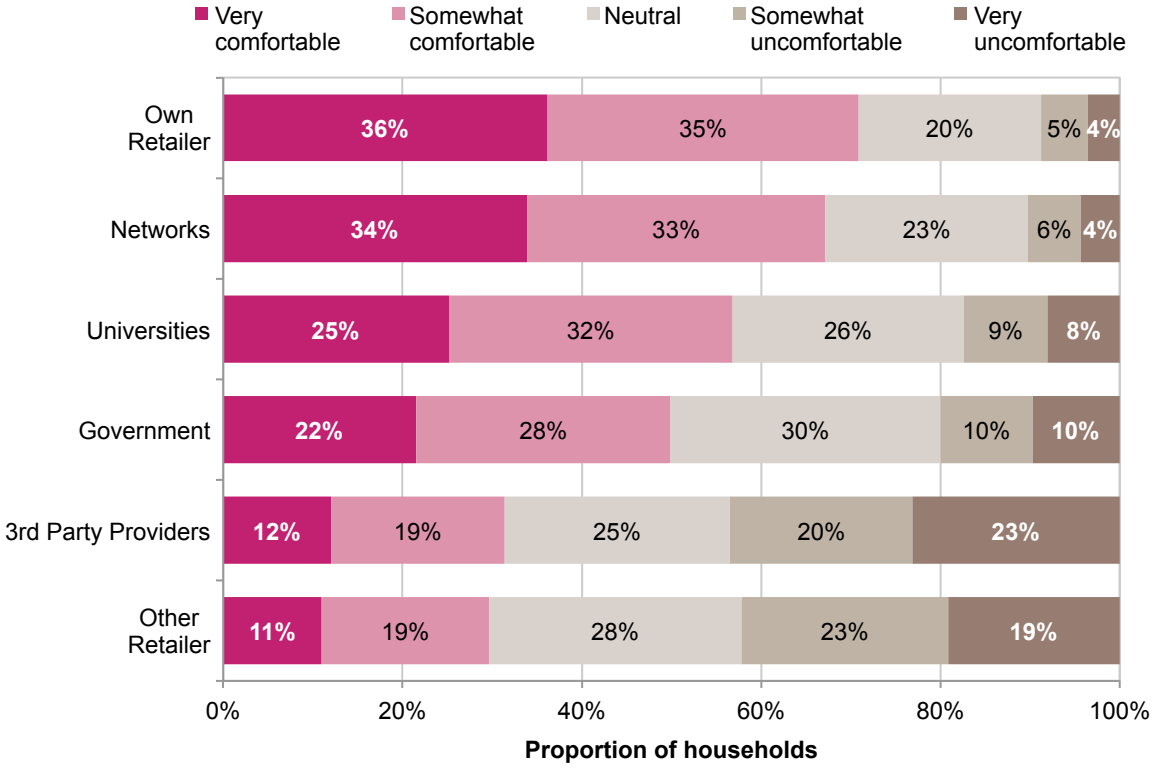
Of those parties that did not already have access to this data, 59% of respondents were comfortable with sharing of data with universities, followed by government at 49%. The largest concerns related to sharing this data with third-party service and product providers, and with other retailers. For both third-party providers and retailers, over 40% of respondents were somewhat or very uncomfortable about sharing their data, compared to 20% or less for sharing it with any of the other parties.

No statistically significant differences were found between trial respondents and the control group. The results were also similar between respondents in network trials and respondents in retail trials. Likewise, there was no significant difference between those

[31] From responses to 'Which of the following statements do you align more closely with? I want products that reduce my electricity bills by helping me understand and manage my electricity use; I want products that reduce my electricity bills without me having to think about it.' (Q.B7a; n=3378).

who rated privacy of energy consumption data as 'important' or 'very important' (in Section 3.2.1) compared to those who didn't rate it important.

Figure 22: Level of comfort with sharing of electricity data with different parties



From responses to: 'Regarding privacy of detailed household electricity consumption data more generally (not relating to the Smart Grid, Smart City trial), please rate your level of comfort over the sharing of your data by the following parties: your electricity network operator; your electricity retailer; other electricity retailers; government; universities or research organisations; third party providers offering new products or services to reduce costs or consumption' (Q.B6, n=3378).[32]

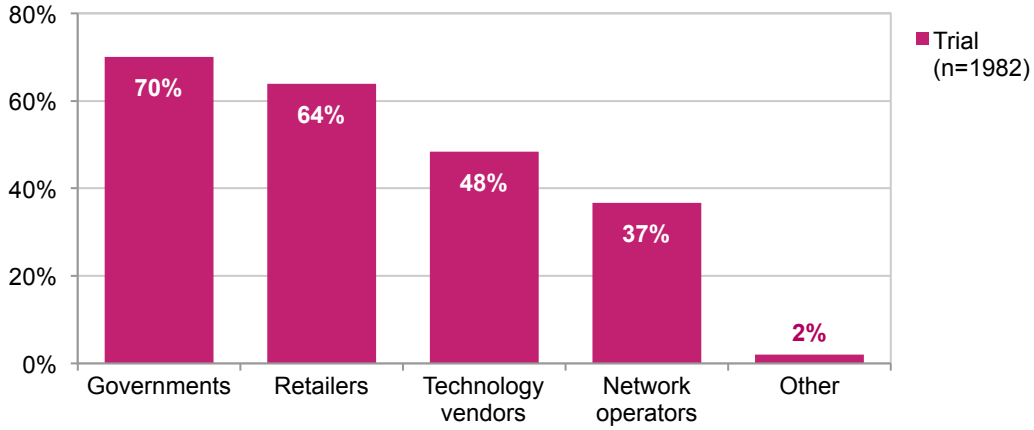
3.2.4 Responsibility for smart grid awareness and education

Respondents were asked what types of organisations they thought should be responsible for awareness and education programs about smart grid technologies (Figure 23). Governments rated highest (71%), followed closely by retailers (65%), then technology vendors (50%) and network operators (39%).

There was very little difference between trial group responses from Network and Retail trial respondents.

[32] Note in the 2013 version of the survey, the wording of the question was 'sharing of your data *by* the following parties'. The wording was adjusted to make clearer the intention of this question is to test level of comfort on the use of personal energy consumption data by different organisation types. It is not expected that the original wording would have been misinterpreted to the extent that the 2013 data is invalid and so it has been included.

Figure 23: Preferred responsibility for smart grid awareness and education



From responses to: 'Who of the following do you think should be responsible for awareness and education programs about smart grid technologies? Governments; Electricity retailers (responsible for billing and customer service); Electricity network operators (responsible for the poles and wires); Smart grid technology vendors; Other; Don't know. You may select more than one answer.' (Q.D3, n=1982). NB. Respondents were allowed to select more than one category, therefor percentages do not sum to 100%.

4

Survey Results

The bulk of survey responses are presented in this chapter. Results are split into three sections:

1. **Product Interaction:** how respondents interacted with their chosen products throughout the trial[33]
2. **Product Impact:** the impacts and effects that trialling the products had on respondents' households and lifestyles
3. **Product Conclusions:** respondents' overall responses to their products.

In general, the overall results of each survey question are presented, and any statistically significant differences in responses are discussed where relevant. These differences may be according to the product type, the feedback technology type or pricing/incentive type. For certain key questions, associations with demographic characteristics of respondent households were also tested, and these are highlighted where statistically significant.

Further insights on the differences in respondent experiences and conclusions based on their product type are provided in Section 4.2.

4.1 PRODUCT INTERACTION

Surveyed participating households trialled one of 18 products, which were classified into the following three groups:

- Type 1: a pricing or incentive mechanism (e.g. a tariff or rebate)
- Type 2: one or more home energy data feedback technologies
- Type 3: a combination of pricing/incentive and one or more feedback technologies.

The only exception was the Network 'Lifestyle Assessment' (N3) which consisted of a home energy audit and report.

Thirteen of the 18 products included one or more of the following three home feedback technologies, either on their own or in combination with a pricing/incentive structure:

- Online portal ('Portal') with both desktop and mobile/smart phone access
- Home energy monitor ('Monitor')
- Home area network (HAN) with appliance control smart plugs, which was also accessed through the online portal ('Portal+HAN').

Thirteen products included a pricing/incentive structure, either on their own or in combination with one of the feedback technologies above:

- Peak Rebate (dynamic peak rebate)
- PriceSmart (dynamic peak pricing)
- SeasonSmart (seasonal time of use)
- BudgetSmart (top up reward plan).

Refer to Section 1.2.4 for a full list of the products.

This section presents questions about respondents' experiences in using their trialled product. It explores some of the unique aspects of the suite of products, covering issues such as understanding of the product, interaction with feedback technologies, interaction with peak events, and specific customer responses to the lifestyle assessment product.

[33] As defined in Section 1.3, 'product' here refers to one of the 18 Network or Retail products that participants could choose from. They consisted of either a smart grid technology (comprising one or more feedback technology or a distributed energy technology), an SGSC pricing or incentive structure, or a combination of the two. In addition, one product consisted of an education-based measure with no change to the customer's tariff and no feedback technologies offered.

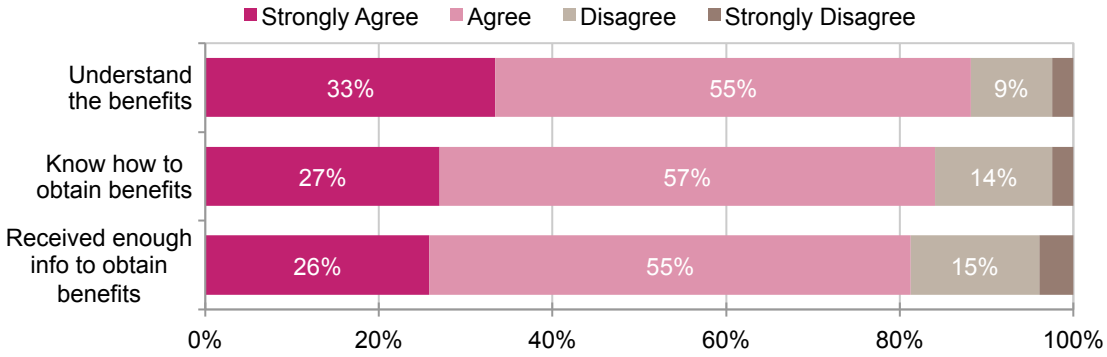
Where results differed meaningfully by product group, results are analysed according to i) Type 1, 2 or 3 as listed above, ii) their feedback technology or iii) their pricing/incentive type.

4.1.1 Understanding of products

Most respondents understood the potential benefits of their product, with over 80% agreeing or strongly agreeing that they i) understood the benefits of the product, ii) knew what to do to obtain the benefits and iii) received enough information to take advantage of their product (Figure 24).

Even so, almost one in five respondents felt that they did not receive enough information to take full advantage of the benefits of their product. This may reflect upon the adequacy of communication and the materials provided to participants for each specific product trial.

Figure 24: Participant understanding of trialled products



From responses to: "To what extent do you agree with the following statements in relation to your product? 1) My household understands the potential benefits of this product; 2) My household knows what to do to obtain these benefits; 3) My household received enough information to take advantage of this product". (Q.C3; n=2358) NB: Participants with Product N7 (Online Portal and Energy Monitor) were asked this question twice, once for each technology.

There were some statistically significant response patterns that emerged when looking at responses by the type of product, and for relevant products, the type of pricing/incentive and feedback technology.

When categorising products as Types 1, 2 or 3, Type 3 products (combination of pricing/incentive and feedback technology) had the highest proportion agreeing with each of the three statements, and Type 2 (technology only) the lowest.[34] This suggests that the benefits of alternative tariffs were clearer to customers, and this was enhanced when feedback technologies were provided in the home. Providing information through feedback devices alone leaves some households without a clear sense of how they can benefit from the product.

When analysing responses according to the type of feedback technology, the group of respondents with a Monitor[35] consistently had a higher proportion of people agreeing with each of the three statements than did those with the Portal. The HAN products performed similarly to the Monitor, however fewer respondents felt they received enough information

[34] Kruskal Wallis Test, p<0.001. See Appendix 7.3.1.1 for graph.

[35] Participants with Product N7 (Online Portal + Monitor) were excluded from this analysis.

to take advantage of the product.[36] This clearly more complicated product type may require a greater level of explanation at the product delivery/installation stage.

When looking at the type of pricing/rebate, the group of respondents with the Network Peak Rebate product consistently had a higher proportion of people agreeing with each of the three statements regarding the understanding of product benefits. BudgetSmart was the next-best performer, followed by PriceSmart. SeasonSmart consistently had the lowest proportion of people agreeing with each of the three statements.[37]

4.1.2 Home feedback products

As described in the introduction to Section 4.1 above, 13 products included one or more of the three feedback technologies (Monitor, Portal or Portal+HAN). This section explores the specific experiences of respondents in using these feedback technologies. Where relevant, the reporting of these questions disaggregates the results by technology type rather than by product, and where appropriate, the results for products that contain multiple technologies have been split into multiple responses – one for each technology.

4.1.2.1 Ease of setup/use

Most respondents found the technologies easy or very easy to set up (75%) and use (72%) (Figure 25). The Monitor was considered the easiest to set up (77% easy or very easy), compared to Online Portal (71%) and home area network (HAN) (70%), but respondents rated the HAN as “very easy” much less often than they did for the other two technologies.

Once set up, respondents found the three technologies to be similar in their ease of use (from 70% to 73%). Again however, the HAN was less often rated as “very easy”. This suggests that while the HAN was more complex to set up and operate, this does not strongly impact people’s ability to use the technology.

Interestingly, when looking at these results according to the product Types 1, 2, and 3, those whose feedback technology was combined with a pricing/incentive (Type 3) had higher proportions of users rating their feedback technology as easier to set up and use than those with the feedback technology only (Type 2). This is a counter intuitive finding, given the feedback technologies across these products were identical. One of few plausible explanations is that there may have been a degree of customer self-selection bias in the product types, if customers with higher technology literacy were more likely to choose the Type 3 combination products. This was could not be tested with the available data.

All of these differences were found to be statistically significant.[38]

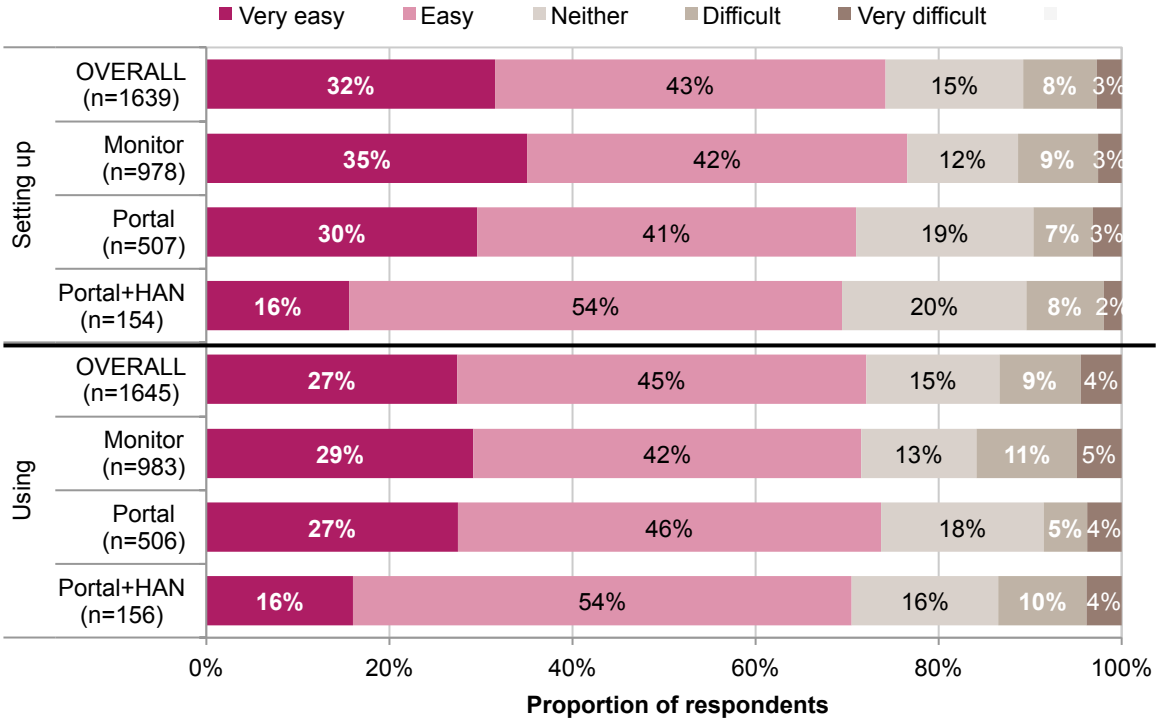
Statistical testing for associations between ease setting up and using, and demographic factors including language, income, household ownership or historical energy consumption found no clear trends.

[36] Kruskal Wallis Test, p<0.001 (Understanding benefits, Obtaining benefits), p=0.042 (Receiving info). See Appendix 7.3.1.1 for graph.

[37] Kruskal Wallis Test, p<0.001. See Appendix 7.3.1.1 for graph.

[38] Chi-squared test, Setting up p<0.001 (Product type, Technology type); Using: p<0.001 (Product type), p=0.005 (Technology type).

Figure 25: Ease of setup/use of feedback technology, by technology type

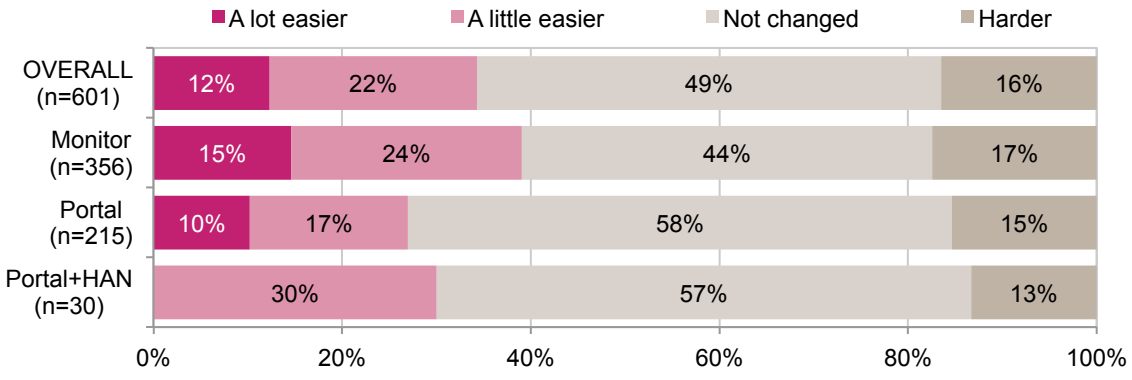


From responses to: "How easy were each the following: Setting up your product? Using your product?" (Q.C8; n=1629) NB. Participants with a technology bundle were asked this question twice, firstly for the Online Portal, and secondly for either the Energy Monitor or control of specific appliances with the HAN through the Portal. Responses to the first instance were added to "Portal" responses, while responses to the second instance were added to "Monitor" or "Portal+HAN" as appropriate.

Participants who responded to the 2013 survey (Figure 26) were asked to rate their perception of the change in ease of use over the same period (i.e. 'how has the ease of use of your product changed over the last 6 months?'). While almost half (49%) of respondents felt ease of use was the same, those who thought it had changed were more likely to say that using their product had become easier.

There were few differences between the different technology types in terms of perception of change in ease of use, and they followed the same pattern as above, with a slightly higher proportion of people using the Monitor reporting that it had become easier compared to Portal and HAN, and no HAN respondents reported that it had become "a lot easier".

Figure 26: Change in ease of use over last six months



From responses to: "How has the ease of use of your product changed over the last 6 months, since you completed the first survey? Become a lot easier, Become a little easier, Not changed, Become harder" (Q.C8a; n=601, Repeat respondents only)

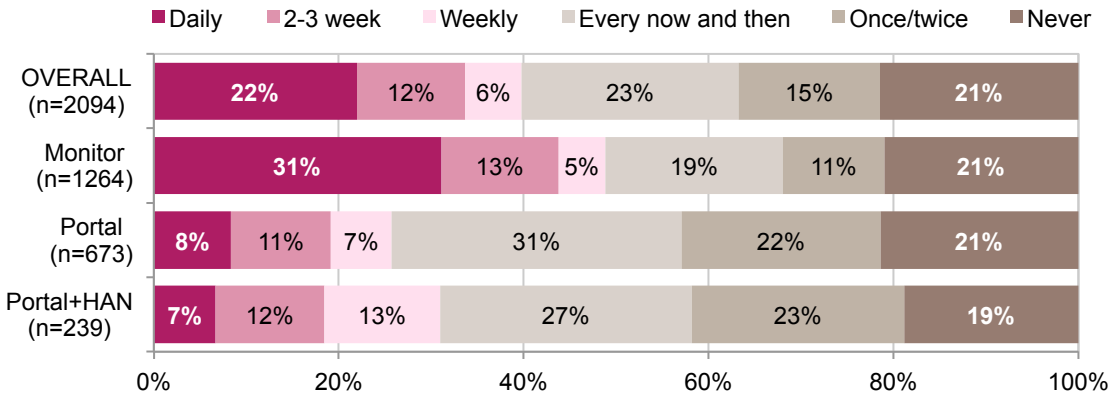
4.1.2.2 Frequency of use

There were very diverse results for how often people used their feedback technologies. As it was assumed that people with more than one technology might use the each technology differently, this question was asked separately for each technology. Forty per cent of respondents used their technology at least weekly with 22% using it on a daily basis (Figure 27). However roughly a third (36%) of respondents had never used their technology, or had only used it once or twice.

People with a Monitor more often reported more frequent use than those with the Online Portal or home area network and this difference was statistically significant.[39] Almost half (49%) used their Monitor at least weekly, including almost a third who used it daily. This compares with roughly a third who used the home area network (32%) at least weekly and a quarter (26%) for the Online Portal. There was no statistically significant difference between the frequency of usage of the Online Portal and HAN, which was not unexpected given that the HAN requires users to log in through the Online Portal. The data suggests a clear advantage of home energy monitors for capturing user engagement, probably due to the lower entry barriers as the device was in sight within the home and does not require a dedicated login.

Those respondents whose feedback technology was combined with a pricing/incentive engaged more frequently with their feedback technology than those with the feedback technology only.[40] This reinforces the finding that improved customer outcomes were achieved by pairing pricing/incentives with feedback devices.

Figure 27: Frequency of usage of feedback technology



From responses to: "How often do you use the product that you are trialling?" (Q.C2; n=2094) NB. Participants with a technology bundle were asked this question twice, firstly for the Online Portal, and secondly for either the Energy Monitor or control of specific appliances with the HAN through the Portal. Responses to the first instance were added to "Portal" responses, while responses to the second instance were added to "Monitor" or "Portal+HAN" as appropriate. For respondents that answered 'Never' their survey was terminated after this question.

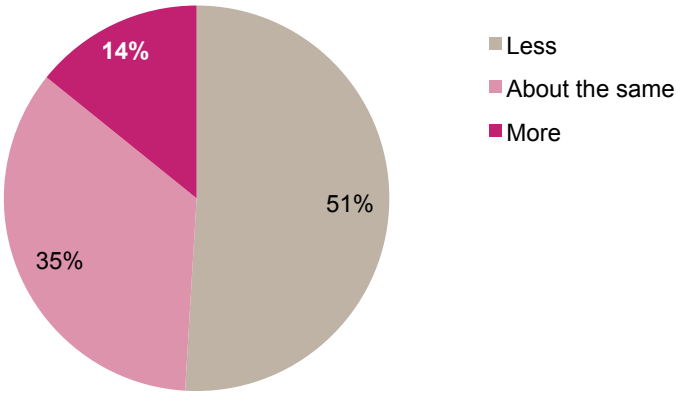
This was reinforced by the comparison with actual savings estimate analysed in Section 5.3.1.1, which found that those who reported engaging with their feedback technology

[39] Kruskal Wallis test: p<0.001 (Technology type, Product type).
[40] Kruskal Wallis test: p<0.001 (Technology type, Product type).

daily or 2-3 times per week had both higher overall savings and higher peak savings, than those who only engaged with it weekly or less often.

When respondents were asked how their use of feedback technologies changed as the trial progressed, half (51%) of respondents reported that their usage decreased in the course of the trial while a third (35%) of respondents reported that their usage of the technology remained the same over time (Figure 28). Only 14% reported that their usage increased in the course of the trial. There were no observable differences between the three technology types.

Figure 28: Change in feedback technology use over time



From responses to: "Did you use it more or less over time?" (Q.C2c; n=1317)

Participants were asked to explain the reason for the change in their level of use of their feedback technology over time. Responses for those people whose engagement decreased are shown in Figure 29.[41]

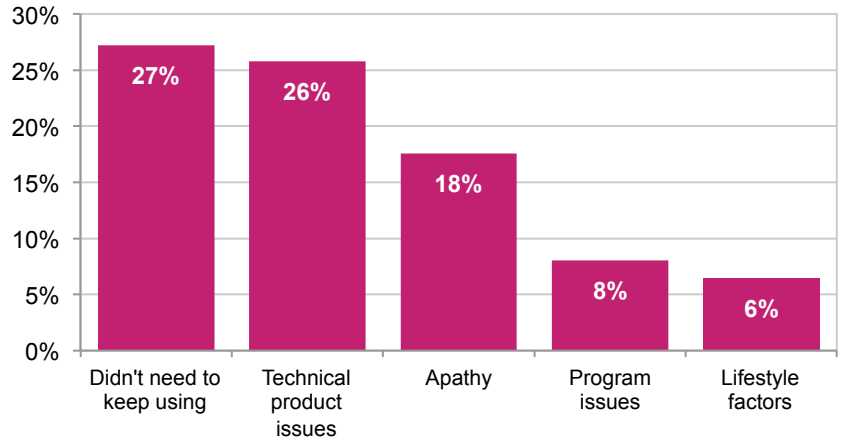
For just over a quarter (27%) of respondents, the reason for the reduced engagement was in fact positive, because they initially used their feedback technology a lot while they were learning about their electricity use, but once they had worked out which appliances used the most electricity and which actions saved the most electricity, they were able to reduce their engagement to just regularly checking in to make sure they were still on track.

Other reasons for decreasing engagement were:

- **Product faults** (26%): respondents gave up trying to use products that didn't work or were unreliable.
- **Apathy** (18%): the novelty wore off, they lost interest, forgot about it, got lazy, or couldn't see it making any difference.
- **Program Issues** (8%): product dislikes, feedback information not helpful, issues with location of meter, incentives/reminders stopped after an initial period.
- **Lifestyle factors** (6%): lack of time, not at home, changes in household circumstances, other things began to take priority.

[41] Reasons for *increased* engagement, or engagement that stayed the same are not analysed in this report. However all responses to this question are included in the data in the Information Clearing House.

Figure 29: Reasons for decrease in feedback technology use over time



From responses to: "Did you use it more or less over time? Why?" (Q.C2c; n=683) Graph shows responses only for those who answered 'Less' in Figure 28.

4.1.2.3Usefulness of feedback information

Participants were asked about the usefulness of a range of features of their technologies. The different features associated with each technology that were investigated are shown in Table 9 below.[42]

Table 9: Features of Feedback technologies investigated

		Monitor	Portal	Portal+HAN
Electricity usage (kWh)	See in near 'real time'	X	X	X
	Track over time	X	X	X
Electricity cost ($)	See in near 'real time'	X	-	-
	Track over time	X	X	X
Appliance usage (kWh)	See in near 'real time'	-	-	X
	Track over time	-	-	X
Receive reminder messages and tips		X	X	X
Greenhouse gas emissions of usage		-	X	X

With the exception of tracking greenhouse gas emissions, all the feedback features were rated by over 80% of respondents as being somewhat or very useful (Figure 30).

The ability to see 'near real time' costs of electricity usage in dollars (66% very useful; 25% somewhat useful), in kWh (60% very useful; 30% somewhat useful) and, for those with the HAN, the ability to track appliance usage over time (58% very useful; 36% somewhat useful) were particularly valued.

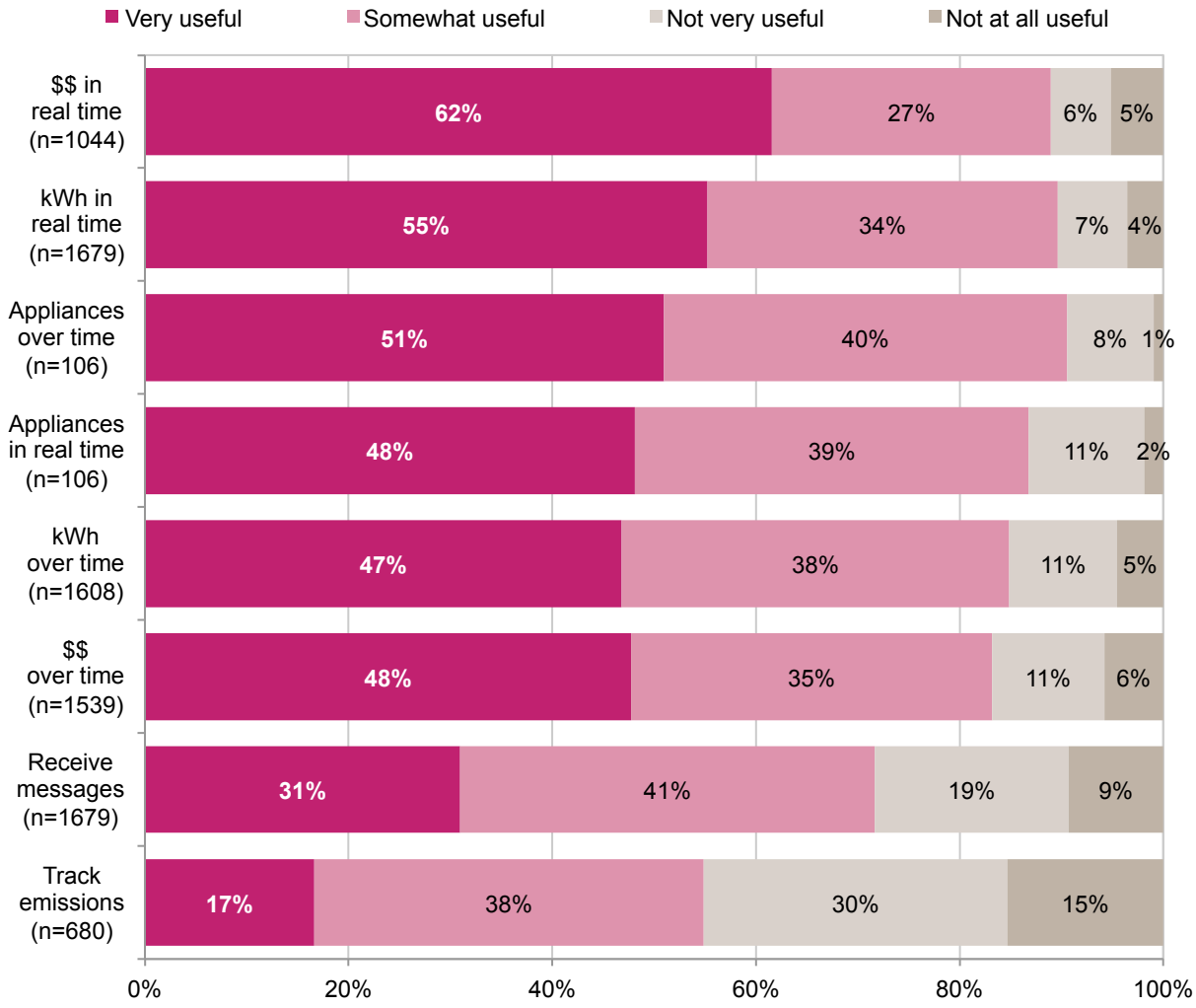
When looking at responses by technology type, those with a Monitor were less likely to rate seeing the change in electricity usage in dollars and kWh over time as useful

[42] Note: additional features asked about in this question are discussed in Section 4.1.2.5.

compared to those with the Portal and HAN, suggesting the Monitor does not provide this information as effectively as the Portal.[43]

Those whose feedback technology was combined with a pricing/incentive mechanism (Type 3), were more likely to rate real time usage, real time costs, efficiency tips, appliance in real time and over time as useful compared to those who had a feedback technology only.[44] This is an intuitive finding, as there were time-of-use incentives associated with these products, however the rating of energy efficiency tips as more useful also suggests that these combination products may increase customers' interest in reducing consumption.

Figure 30: Usefulness of feedback features



From responses to: "How useful would you rate the following features of your product(s)? Being able to see how much electricity (in kWh) you are using at the time you are using it; Being able to set the Monitor to show your electricity use over a period of time; Being able to see how much electricity (in dollars) you are using at the time you are using it; Being able to set the Monitor to show how much your electricity use has cost you over a period of time; Being able to track greenhouse gas emissions; Being able to see appliance usage at the time you are using it; Being able to track appliance usage over a period of time. (Q.C13; n= 1679)

[43] Chi-squared test, p<0.001 (usage over time and cost over time), p=0.001 (efficiency tips).

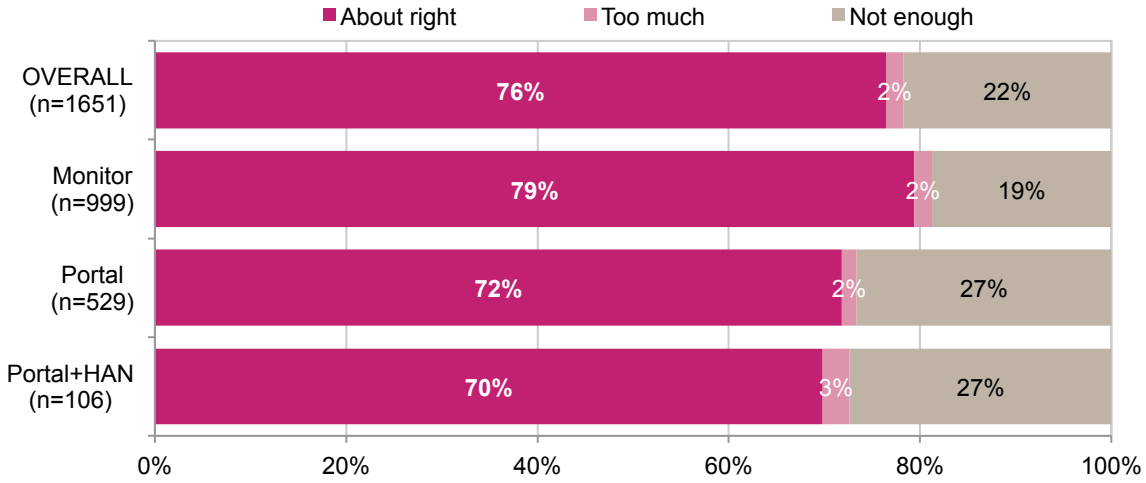
[44] Chi-squared test, p=0.013 (real time usage); p=0.002 (real time costs); p<0.001 (efficiency tips); p=0.02 (appliances in real time); p=0.007 (appliances over time).

The ability to track greenhouse gas emissions over time was less valued than other features, with 47% of respondents describing it as not very or not at all useful. This shows there was less interest in monitoring greenhouse gas emissions than might be expected given responses on energy supply priorities (Section 3.2.1), where more than two-thirds of respondents rated 'receiving electricity supplied from renewable or lower greenhouse gas emission sources' as 'very' or 'somewhat' important.

When asked about their overall satisfaction level with the amount of feedback information provided, more than three-quarters (76%) of respondents reported that the quantity of information provided by the feedback technologies was 'about right', while almost one-quarter (22%) would have preferred more information (Figure 31). The most striking finding was that almost no respondents felt that they were given too much information. Furthermore, the more information provided to customers (firstly through the Portal and then the Portal+HAN), the greater the likelihood of them wanting more information. The difference in responses between technology types was statistically significant.[45]

Interestingly, those whose feedback technology was combined with a pricing/incentive mechanism were more likely to consider the amount of information about right, and less likely to think it too little, compared to those who just had a feedback technology. This different was statistically significant.[46]

Figure 31: Satisfaction with amount of feedback information



From responses to: "Would you rate the overall amount of information provided by your product as: Not enough, About right, Too much?" (Q.C6; n=1615) NB: Respondents with P7 Portal + Monitor bundle were excluded from analysis.

4.1.2.4 Home appliance control feature

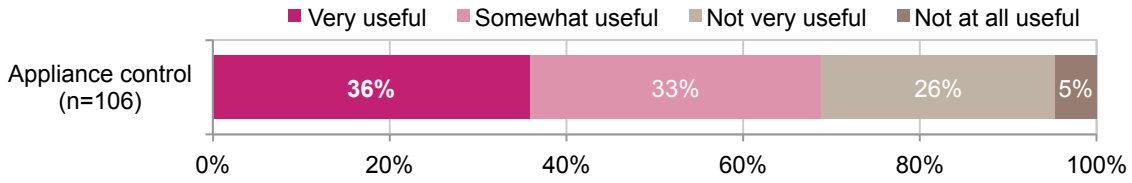
More than two-thirds (69%) of people using the appliance control features with the HAN technology found the ability to turn appliances on and off to be very or somewhat useful (Figure 32). However 31% of respondents rated this feature as 'not very' or 'not at all' useful. This was the second lowest amongst all the features asked about in the survey (following tracking of greenhouse gas emissions). This suggests that certain types of consumers or households were interested in detailed energy information to help them manage their usage, while others were not, aligning with the earlier finding that many households prefer 'set and forget' products over information-based products (Section

[45] Chi-squared test, p=0.007 (Technology type, Product type).

[46] Chi-squared test, p=0.007.

3.2.2). The sample size was not sufficiently large to perform a meaningful demographic analysis to investigate commonalities between households that did, or did not, find this feature useful.

Figure 32: Usefulness of home appliance control feature



From responses to: "How useful would you rate the following features of your product(s)? Being able to turn appliances on and off" (Q.C13.9; n=106)

When asked 'Did you have any concerns about using your appliance control features?', the vast majority of respondents did not have any concerns, with only seven responses (5%) expressing concerns. Five of these related to product problems, and two did not see the value in using the control device for the refrigerator control, as they wouldn't consider switching off this appliance.

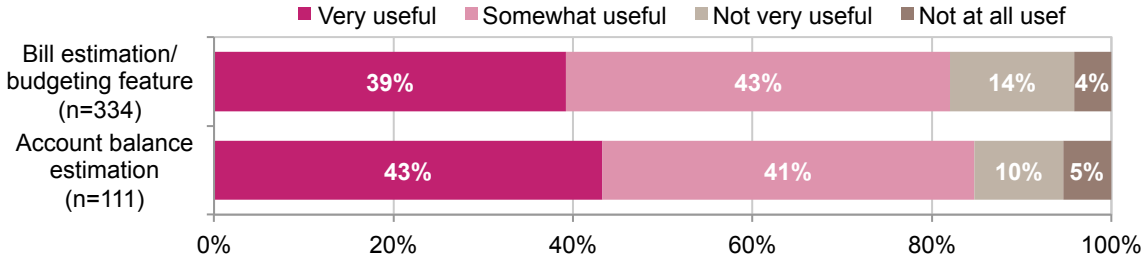
4.1.2.5 Estimation features

Two estimation features were available to Retail participants through the Online Portal product:

1. A bill estimation/budgeting feature (for BudgetSmart, PriceSmart and SeasonSmart when combined with Portal or Portal+HAN)
2. An account balance estimation feature (for BudgetSmart when combined with Portal or Portal+HAN).

Over 80% of respondents found the bill estimation and balance estimation tools to be either very or somewhat useful (Figure 33).

Figure 33: Usefulness of estimation features



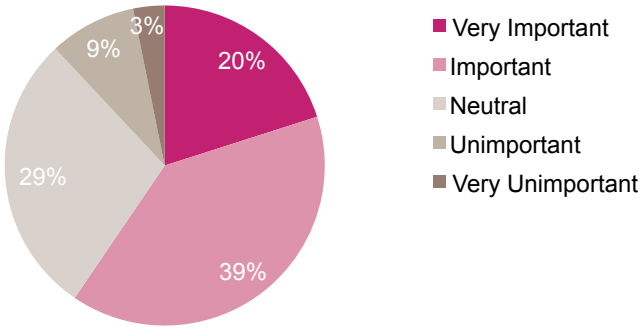
From responses to: "How useful would you rate the following features of your product(s)? Bill estimation and budgeting feature that shows your estimated cost to date and whole bill cost; Account balance estimation showing current balance and projected balance." (Q.C13; n=1679)

When asked about the importance of the bill estimation feature as a driver of behaviour change,[47] 15% of respondents who had this feature available said they didn't use it. Of

[47] This question was adjusted in the 2014 survey. In the 2013 survey, the question was 'How often did you take active steps to reduce your electricity costs after viewing this feature? Always. Often, Sometimes, Rarely, None.' (2013.TQ.C10b, n=148). Responses to the two questions were roughly similar, with 55% saying the bill estimation feature prompted action often or always, and only 10% saying it rarely or never prompted subsequent action.

those who did use the feature, 60% of respondents said it was important or very important (Figure 34). Only 12% thought it was unimportant or very unimportant.

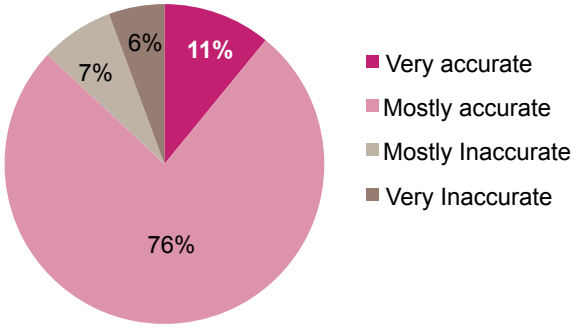
Figure 34: Importance of bill estimation



From responses to: "How important was the estimation of your bill generated by your Online Portal as a tool in driving your behaviour change?" (TQ.C10a; n=334) NB. 50 respondents indicated in answer to this question that they "Didn't use" the feature, and so are not represented in the above data.

Of those who used the bill estimation feature, the majority thought it was at least mostly accurate (87%), though only 11% rated it as very accurate (Figure 35).

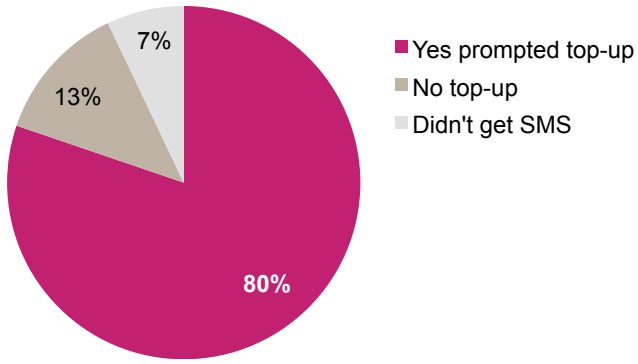
Figure 35: Perceived accuracy of bill estimation feature



From responses to: "How accurate did you find the estimation of your bill generated by your Online Portal?" (Q.C10; n=284)

In addition to the account balance estimation feature available to BudgetSmart participants with the Online Portal, all BudgetSmart participants could receive a low or debit balance SMS. Eighty per cent of respondents with this feature said receiving one of these SMS messages prompted them to top up their account (Figure 36). Seven per cent reported that they didn't receive a balance via SMS, presumably because their balance never dropped below the threshold.

Figure 36: Effect of low/debit balance estimation SMS messages on topping up behaviour

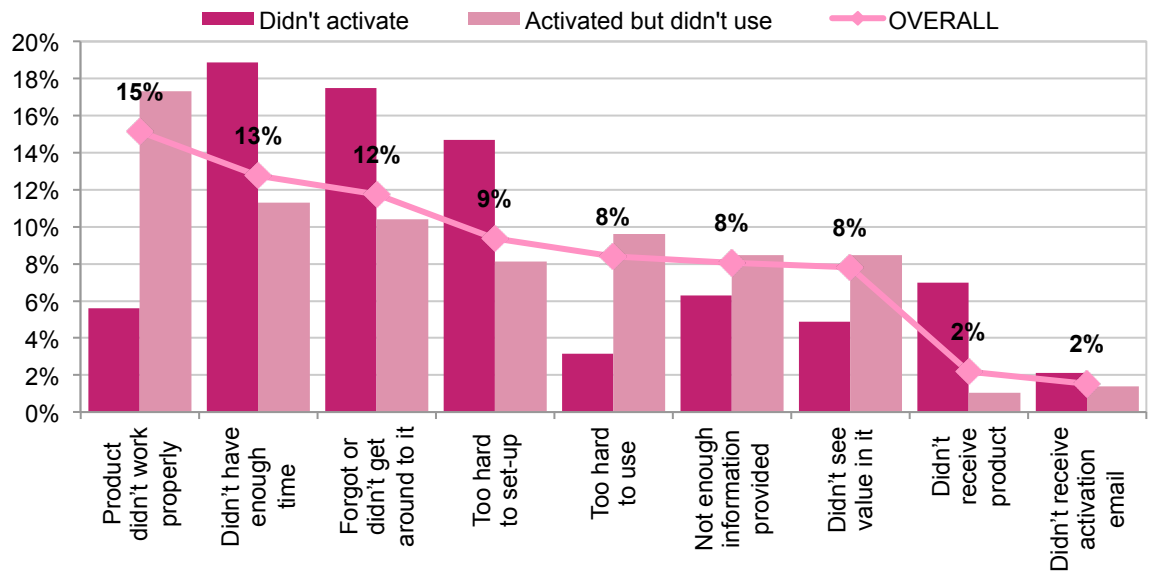


From responses to: "If you received a low or debit balance estimation SMS, did this prompt you to top your account up? Yes; No; Didn't receive SMS" (Q.C10c; n= 354) NB. Only asked of respondents with BudgetSmart products.

4.1.2.6 Reasons for not activating/continuing to use feedback technology

Customers that received a product but did not activate the feedback technology, reported never using it, or only used it once or twice after activation[48] gave a variety of reasons for not continuing their use of the product. As shown in Figure 37, the most common reason given was the product "not working properly" (15%), followed by respondents not having enough time (13%) and forgetting or not getting around to it (12%).

Figure 37: Reason for not activating or never using product



From responses to: "Why didn't you activate your product?" (Q.C1; n=286) and "Why have you never or only once or twice used it?" (Q.C2b, n=1229). NB. Only asked to respondents with a technology, who weren't recorded as using it. Totals do not add to 100% due to rounding.

[48] Respondents who did not activate or never used their product were deemed to be of limited usefulness for the purposes of collecting further survey data on product or trial experiences. These customers therefore only received the household profiling questions and these questions regarding use of their product, before their survey was terminated. Respondents who said they only used their product once or twice were still asked the remainder of the questions in the survey.

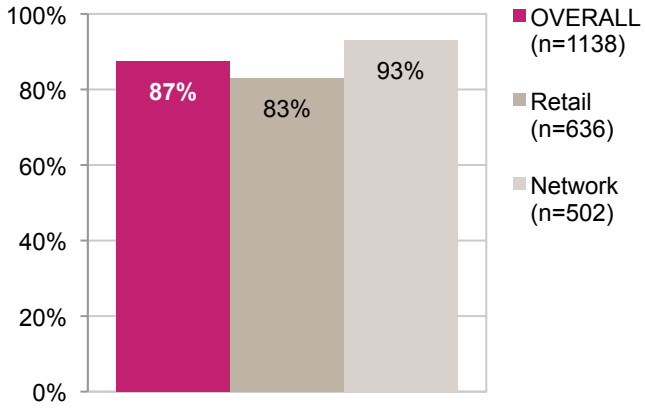
4.1.3 Peak event products

Six of the available products involved specific 'peak events', where the trial operator notified customers 24 hours in advance that an event was occurring, during which time they were encouraged to reduce their usage. Peak events generally aligned with a very hot or very cold day. The network-led trial involved a dynamic peak rebate (Peak Rebate products N4 and N6), which provided a financial rebate to customers who saved electricity during the peak event. The rebate was sent as a payment onto a dedicated customer credit card. The retailer-led trial involved 'dynamic peak pricing' (PriceSmart products R6–R9) which charges a much higher tariff for electricity use during the peak event but offers lower than normal tariffs at other times.

4.1.3.1 Participation in peak events

Over the course of the trials, the trial operator notified customers of 13 peak events for the Network Peak Rebate products, and 7 events for the Retail Peak Pricing products. The respondents were asked to self-report their peak event participation, and both the Network Peak Rebate and the Retail Peak Pricing appear to have been very successful in driving behaviour change. Overall 87% of respondents reported participating in the peak event, with the Network peak rebate performing slightly better than the Retail peak pricing, at 93% participation compared to 83%. (Figure 38). These differences were statistically significant.[49] (Note: Details of *how* respondents participated in the peak events is discussed in Section 4.2.1.)

Figure 38: Self-reported participation in peak events



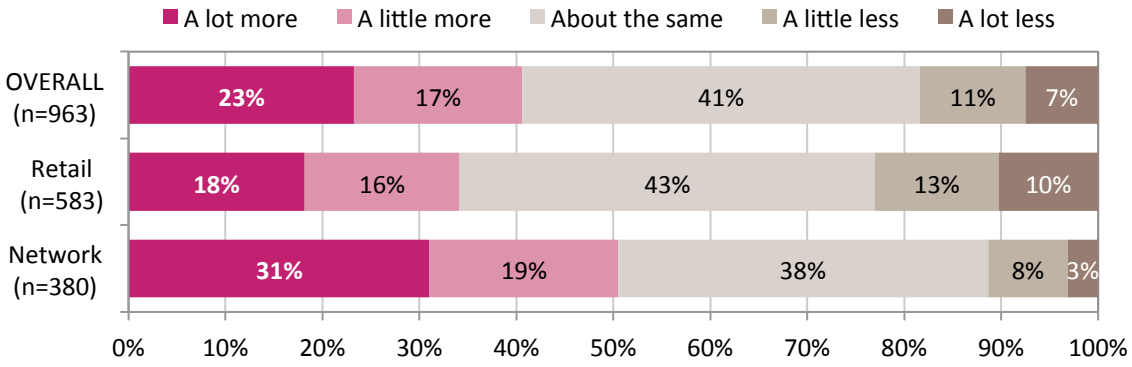
From responses to: For Network respondents, "As a result of a peak event did you receive any rebates (to the credit card provided for the trial)?" For Retail respondents, "Did you reduce your electricity consumption during the peak pricing event?" (TQ.C5d; n=1138), NB. Only asked of respondents who were included in a peak event.

Of those respondents who were notified of more than one peak event, 40% said that they became a little or a lot more interested in participating in peak events over time (Figure 39). The same proportion said their interest stayed the same, while less than 20% said that their interest decreased. Again, the Network Peak Rebate performed slightly better than the Retail Peak Pricing, with more people reporting increased interest over time, although note that the retail trial explicitly chose to test customer fatigue by running events on successive days, particularly towards the end of the trial. This is a promising finding for peak event products, suggesting that the level of fatigue in consumer interest and

[49] Fisher's Exact Test, p<.001.

participation was not high. Some of the common reasons that people gave for the change in their level of participation over time are shown in Table 10 further below.

Figure 39: Change of interest in participating in peak events over time



From responses to: "Please describe why your interest in participating in the peak events changed over time, as more peak events have been called?" Q.C5d3; n=963

Table 10: Reported reasons for change of interest in peak event participation over time

Reasons for INCREASED participation	Reasons for DECREASED participation
• Increased motivation from seeing a good-sized rebate initially • Increased understanding of when events were on and what to do • Increased understanding of consumption and where energy was being wasted • Other household members beginning to get on board (particularly children) • Began to guess when peak event would occur and prepared early	• Peak events became too frequent, and were called even on moderate temperature days and this became irritating and therefore demotivating (a number of respondents indicated they were informed on signing up that there would be 3-4 events per year). **Note:** the retail trial explicitly chose to test customer fatigue by running events on successive days, particularly towards the end of the trial. • Frequency of events made action too inconvenient, particularly with children or elderly in house, or pre-made plans that prevented participation (e.g. dinner parties), especially when they were back to back • Notice of event became shorter and shorter, not enough time to prepare • Reward was not worth the effort, sometimes bill even went up following dedicated effort • Level of savings/rebate varied erratically despite consistent action and so could not learn proper response • Feedback technology started having issues and so couldn't use it to assist participation • Novelty wore off (Peak Rebate only) • Reduced electricity as much as possible at all times, so nothing more they could do during peak event • Issues getting the rebate onto the credit card became frustrating

It should be noted that while the above described the change of ***interest*** in participating over time, it does not necessarily relate to an increased dedication to shifting electricity use during a peak event over time. Figure 39 shows that the average rebate received per event (an indication of the amount of electricity shifted, for the network peak event product only) may show more of a relationship to temperature on the day of the peak event, rather than any clear time-based trend.

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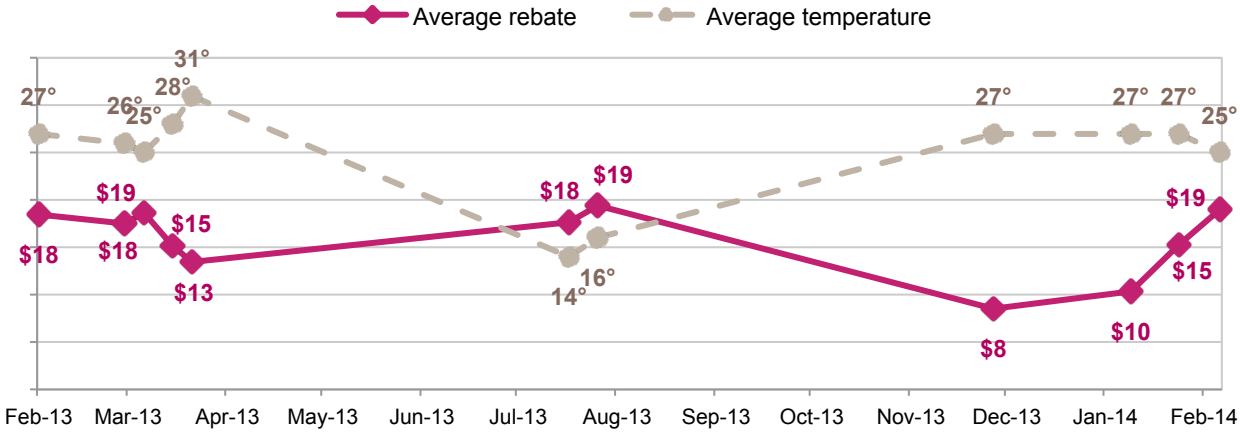
Figure 40: Change of participation in peak events over time according to temperature



4.1.3.2 Non-participation in peak events

The most common reason that people gave for not participating in a peak event was because it was 'too hard' (6.5% of respondents). This may be the proportion of the customer base that is unlikely to ever be sufficiently motivated to participate in peak events.

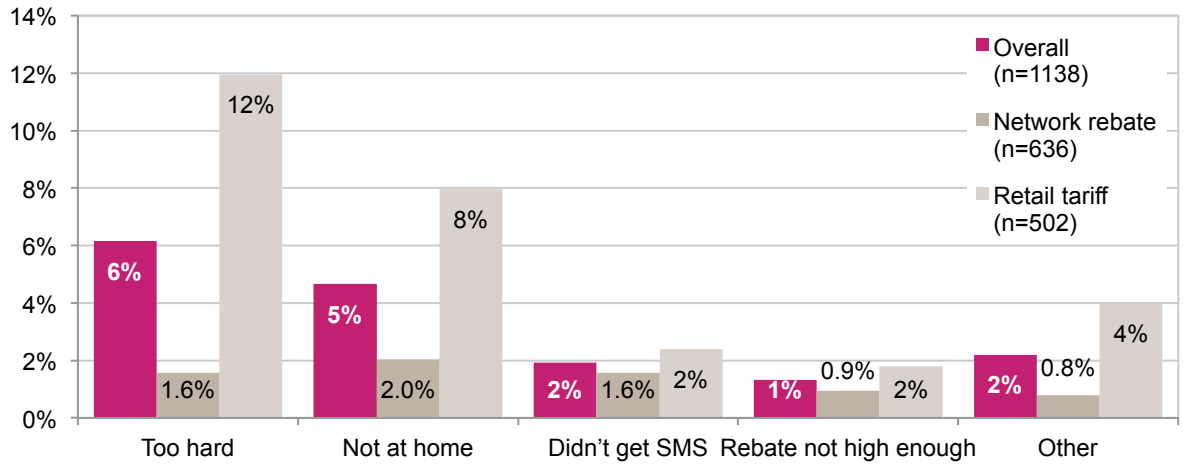
The next-most common reason, given by 5% of respondents, was that they were not at home, and so were not able to reduce their demand. However, if a customer was not at home during that peak event, they were consuming very little energy. There was no way for the trial operator to distinguish between a household with reduced consumption due to occupants being away from home (prompted by their peak event notification or otherwise), or a household that was home but has reduced consumption for the peak event. Therefore a participant being away from home during a peak event effectively constitutes participation in that event. This distinction may need to be made clearer to participants in future.

A very small proportion of people (2%) stated they did not participate as they did not get an SMS (though they were recorded as being sent one).[50] While this could be a technology/system issue, respondents may also have not noticed or forgotten the message, or someone else in the household may have received the SMS without their knowledge. Only 1% of respondents thought the savings/rebates available were not high enough to inspire participation.

[50] This has declined from the 2013 survey, suggesting that as more peak events were called, participants were more likely to take note of and respond to the SMS.

As seen in Figure 41 below, there were interesting differences between the network and retail products, reflecting the much higher proportion of Retail respondents who didn't participate. A much greater proportion of respondents with a tariff product stated that it was 'too hard' compared to respondents with a rebate product (12% vs. 1.6%). This may indicate that people's responses were influenced by how the "reward" for reducing consumption was framed.[51] It was offered either as a carrot (rebate) or a stick (tariff), and this may have influenced some people's perceptions of the level of inconvenience associated with the behavioural change.

Figure 41: Reasons for not participating in peak events



From responses to: "What prevented you from reducing your electricity consumption during peak events? You may choose more than one option." (TQ.C5d2; n=143) NB. Only asked of respondents who were included in a peak event who said they did not participate. Percentage is calculated for total participating and non-participating in events. Respondents could choose multiple answers, so percentages do not sum to 100%.

Other reasons that people gave for not participating in the events included:

- Not understanding how it worked
- The events were at really inconvenient times
- The household didn't use much electricity so was not affected by higher price
- Too hot to respond

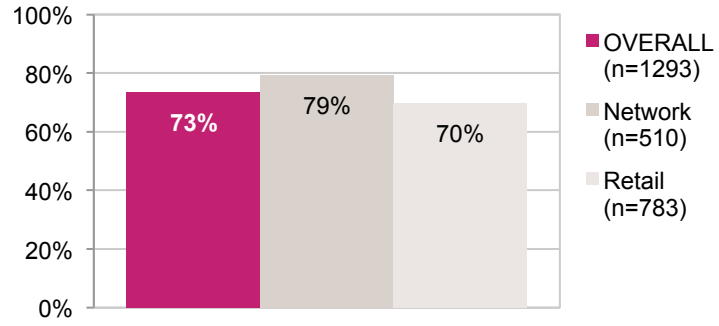
Almost all (94%) of the respondents that received the SMS thought that the level of information provided about the peak event in the SMS was adequate. A slightly higher proportion of respondents with the Network peak rebate products were satisfied with the SMS information (95%) compared to respondents with the retail peak tariff (92%), and this difference was statistically significant.[52]

4.1.3.3 Level of peak rebate/savings

Most respondents were satisfied with the level of rebate or savings, with 73% of respondents agreeing that the available rebate/bill savings were worth their effort in reducing electricity use during peak events (Figure 42). Network peak rebate respondents recorded a slightly higher level of satisfaction than Retail peak pricing respondents.

[51] Although noted that the retail trial explicitly chose to test customer fatigue by running events on successive days, particularly towards the end of the trial.
[52] Pricing/Incentive Type: Fisher test, p<0.001.

Figure 42: Satisfaction with offered level of rebate/bill savings



From responses to: "In relation to the peak events that are part of your product, do you feel the rebate available/savings on your bill are worth your effort in reducing your electricity use during these events?" (Q.C5a; n=1293)

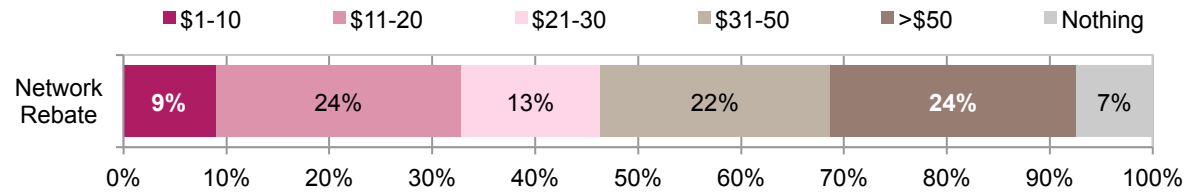
Those that did not consider the rebate/savings offered were asked what the minimum rebate/amount of money saved (in dollars per event) would need to be to make it worth their while.

Figure 43 shows the minimum rebate per event indicated by Network peak event respondents, while Figure 44 shows the minimum savings per quarterly bill indicated by Retail peak event respondents.[53] Note that due to the different timeframes for each product type, these two graphs are not directly comparable. While this does not tell us what changes customers would be willing to make in return for a rebate, it gives some indication of whether raising the offered incentive would increase participation.

For network respondents, the first two categories on the left (<$20) were in line with the average rebate of $15.80 issued per event to those who participated.

The category on the far right labelled "nothing" indicates that no amount of money would entice them to participate in a peak event.

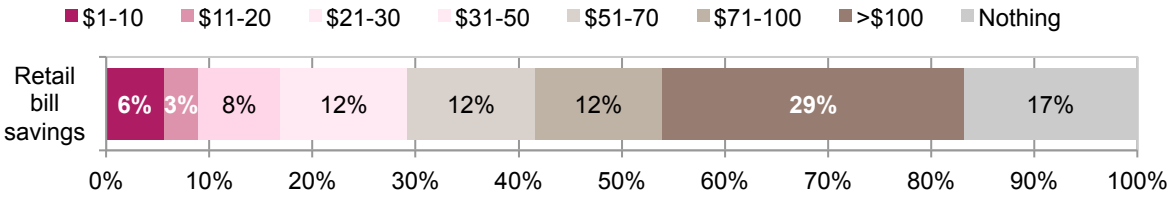
Figure 43: Minimum rebate per event desired to motivate Network peak event participation



From responses to: "What would be the minimum rebate (in dollars per event) that would make [participation in a peak event] worth your while?" (Q.C5b; n=93) NB. Only asked of Network Rebate respondents who stated that the rebate available as part of their product was not worth their effort in reducing electricity during peak events.

[53] For evaluating this data, Ausgrid preferred dollars per event, as this aligned with the rebate product, while EnergyAustralia preferred dollars per bill, as this is how customers see the impacts of their actions on tariff products.

Figure 44: Minimum quarterly bill savings desired to motivate Retail peak event participation



From responses to: "What would be the minimum amount of money savings (in dollars per bill) that would make [participation in a peak event] worth your while?" (Q.C5b; n=93) NB. Only asked of Retail PriceSmart respondents who stated that the potential savings to their bill as part of their peak event product were not worth their effort in reducing electricity during peak events.

There is much industry conjecture surrounding the level of householder commitment to reducing the use of home cooling or heating appliances on extremely hot or cold days, relative to the commitment on moderately hot or cold days. In theory, if all households were willing to reduce consumption on moderate days but not extreme days, the value of peak event products to the network would be zero, as network infrastructure would still need to be sized for the full magnitude of demand on the extreme days. To interrogate this issue, respondents who participated in a peak event and owned electric air conditioning/ heating (as determined in earlier questions) were asked to align themselves with one of the following statements:

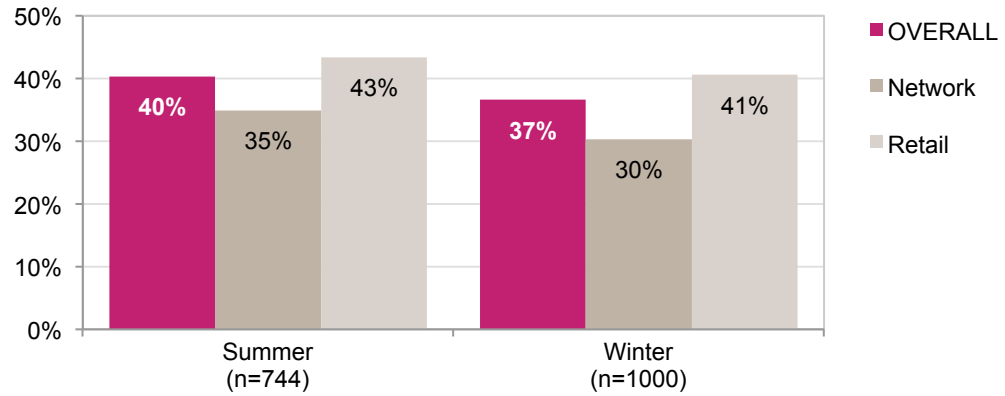
During a winter/summer peak event, I would heat/cool my house less:

1. *to save money no matter how cold/hot the day;*
2. *only on a moderately cold/hot day, but would pay more to heat/cool my home on extremely cold/hot days.*

Figure 45 shows that about 40% of respondents selected statement 1 – i.e. they would participate in the peak event by reducing their heating/air-con use regardless of how extreme the temperature is in order to save money (40% summer, 37% winter). The remaining 60% indicated they would use their heating/air-con less on moderate temperature days but would pay more to heat/cool their house on extreme temperature days.

A slightly higher proportion of Retail peak event tariff respondents indicated they would reduce their heating/cooling on extreme temperature days (43% summer, 41% winter) compared to Network peak event rebate respondents (35% summer, 30% winter). This suggests that the 'stick' of higher prices may be more effective that the 'carrot' of higher rebates on extreme hot or cold days. The results also suggest that summer air conditioning demand may be only slightly more discretionary than winter heating demand.

Figure 45: Proportion of households who would respond to peak event on extreme temperature days



From responses to: "Please indicate which of the following statements you align more closely with: Pair 1: During a winter peak event, I would heat my house: Less to save money no matter how cold the day, Less only on a moderately cold day, but would pay more to heat my home on extremely cold days; Pair 2: During a summer peak event, I would use my air-conditioner: Less to save money, no matter how hot the day; Less only on a moderately hot day, but would pay more to cool my home on extremely hot days" (Q.C5d4; n=1001). NB. Only asked of respondents with a peak event product.

Refer also to Section 5.3.1.5, which analyses actual savings on peak events according to temperature, and note that the temperature-rebate relationship shown in above.

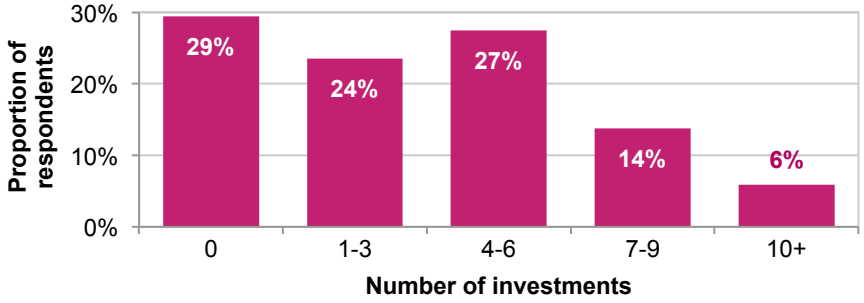
4.1.4 Home energy assessment

The SGSC Home Energy Assessment was unique amongst the products offered in the SGSC trials in that it did not involve changes to tariff structures or trials of smart grid feedback technologies. Instead, each participant was offered an assessment of their options for saving electricity in their house and received a report detailing recommended actions.

This group of respondents was very small (n=42), and as such the results were not statistically robust. Of the small sample, the survey results show that almost all (94%) of the respondents found the assessment report easy to understand.

When asked what energy efficiency investments they had made on the basis of the assessment, just under one-third (29%) indicated they had not made any investments following their assessment. However a quarter (24%) of respondents indicated they had made between one and three investments, while another quarter (27%) indicated they had made four to six investments. One in five households indicated they had made seven or more investments (Figure 46).

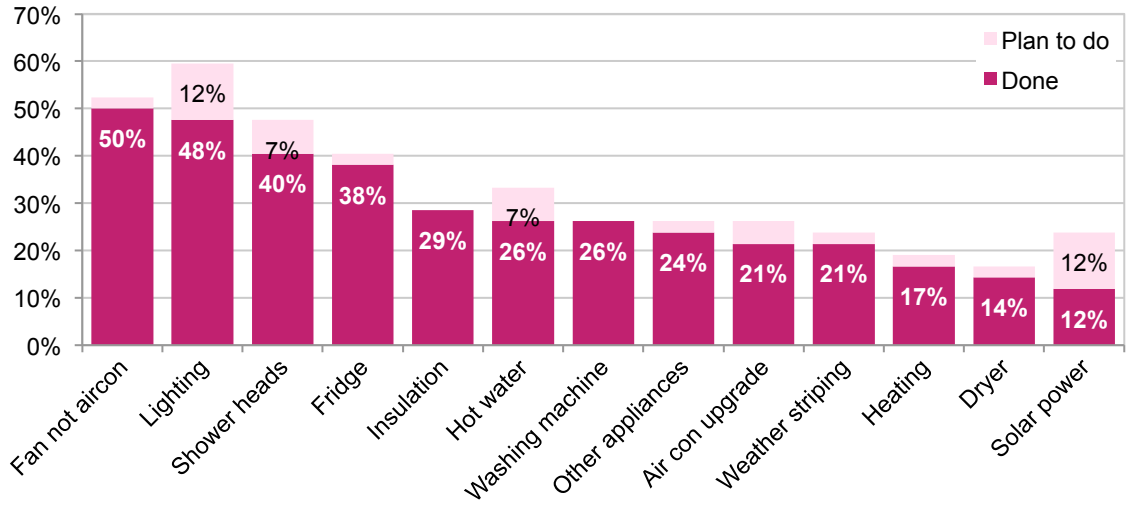
Figure 46: Number of energy efficiency investments following home energy assessment



From responses to: "What, if any, energy efficiency investments did you make, or will be making in the near future, as a result of your assessment recommendations?" (Q.C4b; n=51) NB. Only asked of respondents with the Lifestyle Assessment product.

In terms of what energy efficiency investments the assessment prompted people to make, the most common was using a fan instead of air-conditioning (50%), followed by changes to lighting, showerheads and fridge upgrades (Figure 47). Respondents also indicated that at the time of the survey they were still planning to take make some investment, most notably for solar power and lighting (12% each).

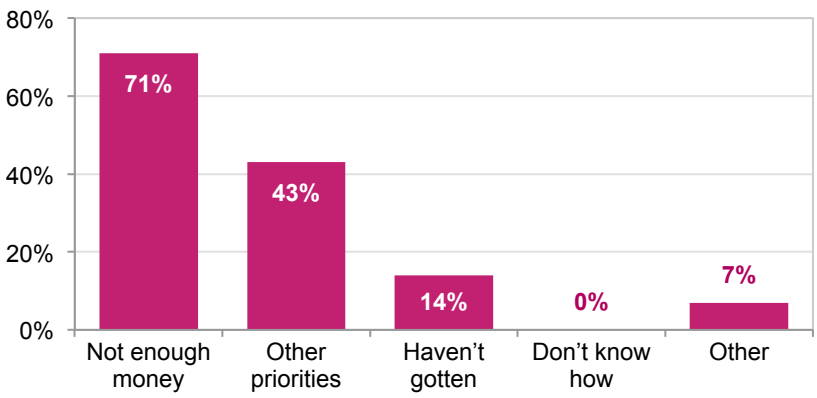
Figure 47: Types of energy efficiency investments following home energy assessment



From responses to: "What, if any, energy efficiency investments did you make, or will be making in the near future, as a result of your assessment recommendations? You may choose more than one option." (TQ.C4b; n=42) NB. Only asked for respondents with the Lifestyle Assessment product. Respondents could choose more than one option so responses do not sum to 100%.

Participants who indicated that they planned to take an action but had not yet implemented it, were asked why (Figure 48). Nearly three-quarters of respondents (71%) said the reason they had not yet implemented a planned action was that they did not have enough money. Another 43% said they had other priorities, while 14% said they just had not gotten around to it. This suggests that access to capital finance is still a principal barrier to residential energy efficiency investment.

Figure 48: Reasons for not yet implementing planned energy efficiency investments



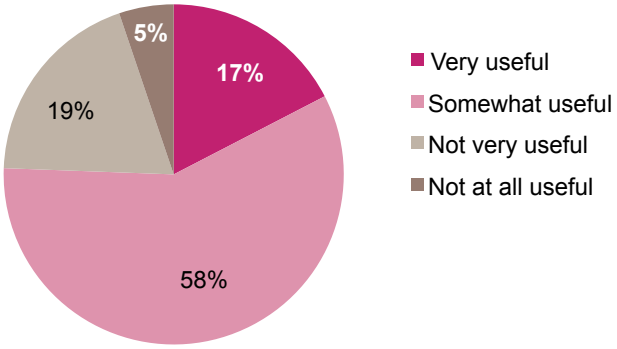
From responses to; "Why haven't you implemented your planned actions yet?" (Q.C4c; n=14). 2014 respondents only. Only asked of respondents with the Lifestyle Assessment product who indicated that they

planned to take an energy efficiency investment in the future. Respondents could choose more than one option so responses do not sum to 100%.

4.1.5 Energy efficiency handbook

All trial participants were provided with an energy efficiency handbook and were asked whether they found it useful. Almost 20% of respondents reported that they were not aware of receiving the handbook. Of those who reported receiving it, three-quarters found it useful to some extent, though they responded with 'somewhat useful' much more often than with 'very useful' (Figure 49), indicating that there may be room for improvement to the handbook or the form in which information on energy efficiency was provided. Only 5% believed it to be not at all useful.

Figure 49: Usefulness of energy efficiency handbook



From responses to: "How useful did you find the Energy Efficiency Handbook that was sent to you by post in June/July? Very useful, Somewhat useful, Not very useful, Not at all useful, Did not receive." (Q.C12; n=2313).NB. 265 respondents answered "Did not receive" and therefore are not represented in the above graph.

4.2 PRODUCT IMPACT

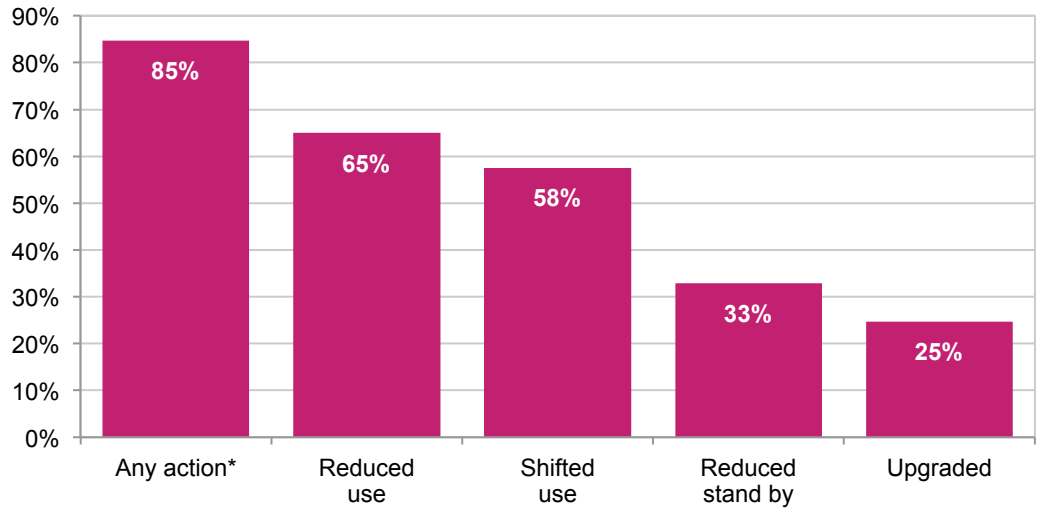
Where Section 4.1 discussed how respondents interacted with their chosen products during the trial, this section presents respondents' perceptions of the impact that trialling their product had on their households and lifestyles. It looks in detail at the effect of their product on their behaviours and actions at home, their energy awareness, literacy and control and the bill savings they were able to achieve.

4.2.1 Behaviour change

4.2.1.1 Type and prevalence of behaviour change

Participants were asked more detailed questions regarding the actions they took in relation to different appliances. 85% of respondents reported taking at least one action on at least one appliance (Figure 50). Participants reported slightly more often reducing the intensity or duration of appliance use (65%) compared to shifting the timing appliance use (58%),[54] and only a quarter of respondents reported they had upgraded an appliance since starting to use their product. The sample size was too small to obtain a reliable comparison of rates of upgrade between those that received a lifestyle audit relative to other respondents.

Figure 50: Proportion of households taking action to reduce consumption



** Includes reducing use, shifting use, reducing stand by or upgrading at least one appliance.*

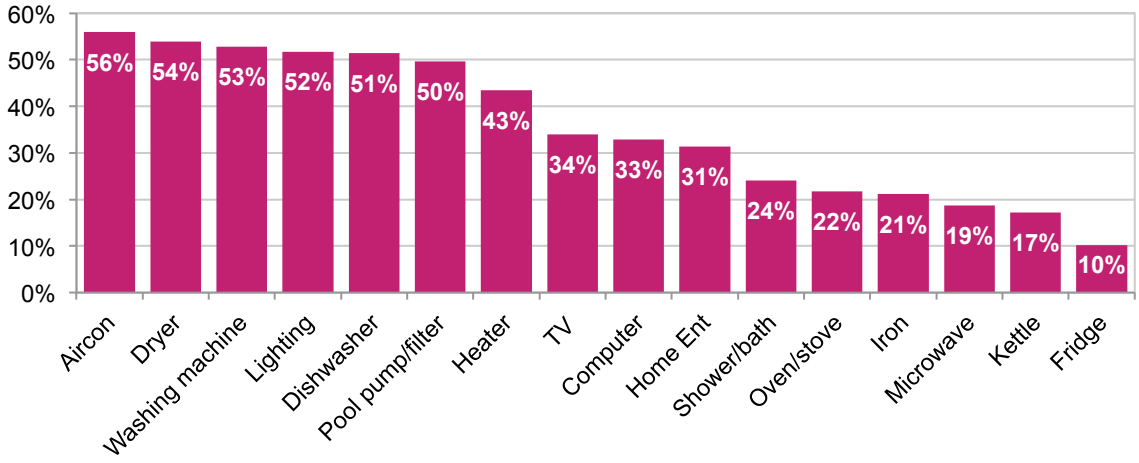
Calculated from responses to: "Since starting to use your product have you and the other people in your home made any changes to how you use the following electrical appliances? If so, how? You may choose more than one option." (Q.C17a, n=1798. 2014 responses only).

Households who reduced the intensity/duration of use of appliances, targeted 3.6 appliances on average, while those households who shifted use targeted 3 appliances on average. Households who reduced standby, did so for 2.5 appliances on average. Households who upgraded, did so for 1.8 appliances on average.

[54] In the 2013 survey, participants were asked directly whether they reduced and/or changed the time of their electricity use because of the trial. A higher proportion reported reducing use (75% compared to 65%) and similar for shifting use (61% compared to 58%). See Appendix Section 7.4.

As shown in Figure 51, of those households that owned a given appliance, at least half took some action for the following six appliances:[55] air-conditioner, clothes dryer, washing machine, lighting, dishwasher and pool pump. As the majority of these were high energy using appliances, it seems that people were effectively choosing to target a small number of appliances with the greatest savings potential.

Figure 51: Household appliances subject to energy saving and time shifting actions



Calculated from responses to: "Since starting to use your product have you and the other people in your home made any changes to how you use the following electrical appliances? If so, how? You may choose more than one option." (Q.17a, n=1798. 2014 responses only) Graph shows the proportion of people with an appliance who indicated taking at least one of the available energy saving or load shifting actions for that appliance. Excludes those reported 'reducing stand by'.

Table 11 shows the proportion of households who took a specific action for each appliance. The colour scale shows the appliance most often targeted (dark pink) to least often targeted (dark grey). It can be seen that the six appliances highlighted above featured strongly across the three main actions (reduce use, shift use and upgrade). The four different actions are discussed in greater detail below.

Table 11: Proportion of households taking action, by appliance

	Took any action	Reduced use	Shifted use	Reduced Standby	Upgraded
Aircon	56%	44%	16%	N/A	3%
Clothes dryer	54%	22%	27%	12%	2%
Washing machine	53%	13%	34%	11%	3%
Lighting	52%	37%	11%	N/A	12%
Dishwasher	51%	14%	34%	7%	2%
Pool pump/filter	50%	14%	36%	4%	2%
Heater	43%	32%	11%	N/A	5%
TV	34%	12%	4%	18%	4%
Computer	33%	10%	5%	19%	2%
Home Ent	31%	12%	5%	18%	1%

[55] Note that for here and below, all percentages represent the proportion of households with that appliance who undertook the action. Households who indicated they did not have the appliance were excluded from calculation of the percentage. See Section 3.1.2 for prevalence of appliance ownership.

Shower/bath	24%	14%	8%	N/A	4%
Oven/stove	22%	13%	8%	N/A	3%
Iron	21%	10%	10%	N/A	1%
Microwave	19%	8%	3%	7%	2%
Kettle	17%	12%	4%	N/A	2%
Fridge	10%	5%	1%	N/A	4%

Calculated from responses to: "Since starting to use your product have you and the other people in your home made any changes to how you use the following electrical appliances? If so, how? You may choose more than one option." (Q.17a, n=1798. 2014 responses only).Percentage shows the proportion of households with each appliance who undertook the specified action for that appliance.

As shown in Table 11, households that **reduced either the duration or intensity of use** targeted four main appliances: air conditioning, lighting, heating, and clothes dryers. Households that **shifted the time of use** also targeted four main appliances: pool pump/filter, dishwasher, washing machine and clothes dryer. Usage of these appliances tends to be less time critical, and they often come with built-in time delay features. Note that home heating/cooling devices were much less commonly time shifted, as households focused more on reducing the duration or intensity of these appliances.

Respondents were also asked if any of the energy saving actions on each appliance involved the **reduction of 'standby' power** only. This refers to turning appliances such as microwaves, computers or home entertainment systems off at the wall to avoid a constant low-level power usage. As appliance power usage in standby mode has reduced substantially in recent years, this perhaps represents a greater energy saving opportunity in the consumer consciousness than in practice. Overall, 33% of respondent households turned at least one appliance off at the wall to reduce standby power usage, and as such this action was still relatively common practice despite reductions in the amount of power that appliances use when on standby. Computers, TVs and Home Entertainment Systems were most commonly targeted, and to a lesser extent clothes dryers and washing machines.

Appliance upgrades were the least frequent action taken by households. The main upgrade that people chose was for lighting, undertaken by 12% of households (Table 11). Customers had generally used their products for a period of 6-17 months when surveyed. Average appliance stock turnover rates are in the order of 8 years for whitegoods (12% per annum) and 3–5 years for many other appliances (20–33% per annum). Compared to these rates, the replacements noted by trial respondents were quite low. Whether this was because respondents only noted strictly "energy efficiency-driven" replacement decisions is unclear, but the data appears to suggest that the use of the trialled smart grid products does not necessarily strongly improve uptake rates of energy efficiency upgrades.

There were no substantive differences amongst other appliances, with a small number of households upgrading each of the other appliances. Interestingly, while the differences were small, the order of appliances targeted was different to the order for reducing or shifting use, with some of the appliances that were lower down these lists (fridge, TV, shower/bath) appearing higher on the upgrade list.

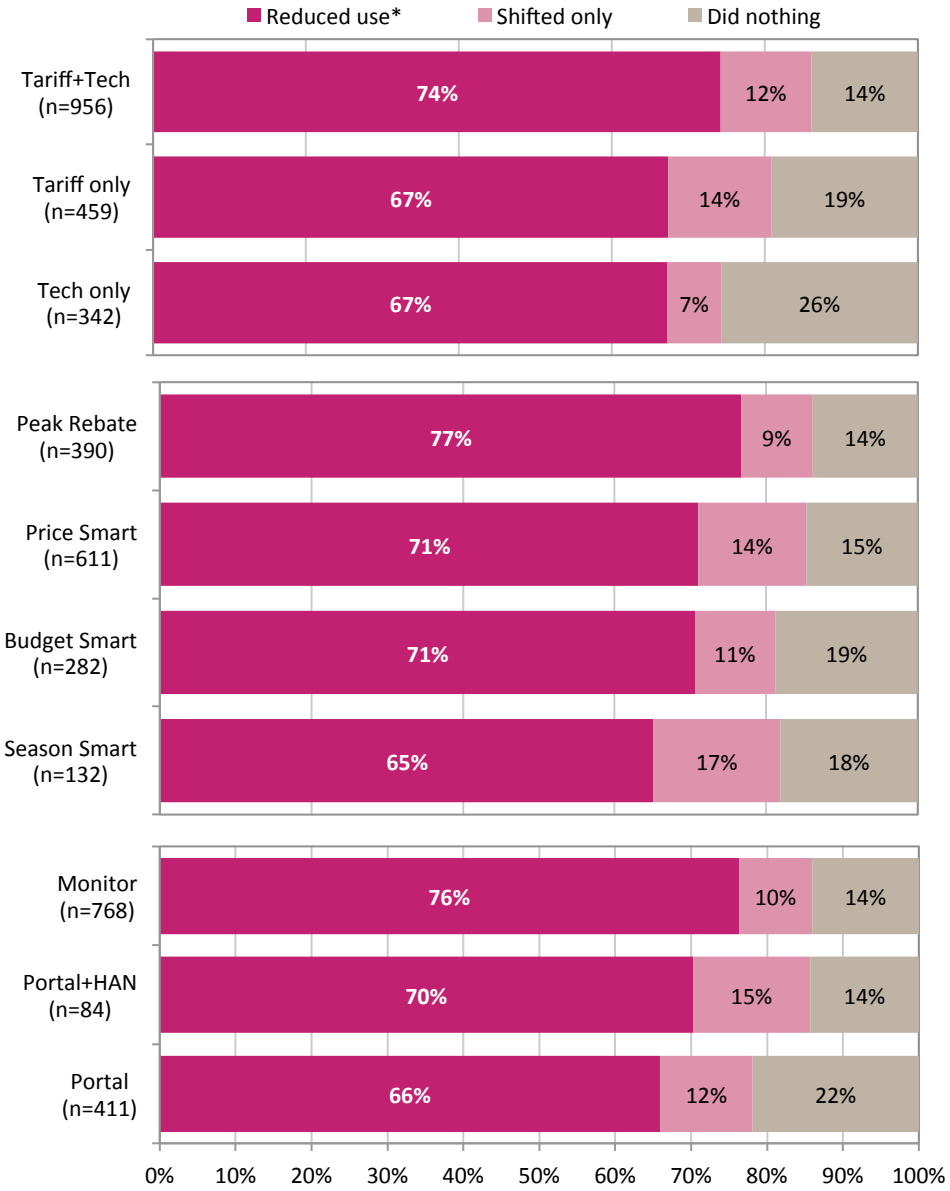
For analysis of actual savings relative to reported actions taken refer to Section 5.3.1.1.

4.2.1.2 Prevalence of behaviour change by product type

Consistent trends emerge when looking at reported behaviour change by product type,[56] pricing/incentive type, and technology type, as shown in Figure 52 below. Those with pricing/technology combination products (Type 3) reported greater prevalence of behaviour change, while peak event products (Peak Rebate and PriceSmart) drove the highest behaviour change rates, and the Monitor outperformed the computer-based Portal.

Product-specific results are provided in Appendix 7.3.2.

Figure 52: Type of reported behaviour change by product type 1–3 (top), pricing/incentive type (middle) and technology type (bottom)



Calculated from responses to: "Since starting to use your product have you and the other people in your home made any changes to how you use the following electrical appliances? If so, how? You may choose more than

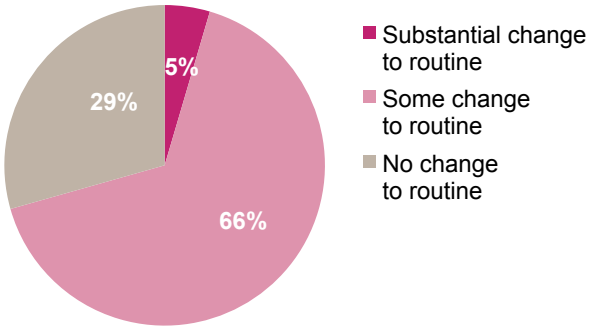
[56] That is, by Type 1: pricing or incentive structure only, Type 2 feedback technology only, or Type 3 combination of pricing/incentive and one or more feedback technologies.

one option." (Q.17a, n=1798. 2014 responses only).Percentage shows the proportion of households with each appliance who undertook the specified action for that appliance.

4.2.1.3 Magnitude and convenience of behaviour change

Two-thirds of respondents reported that the energy saving and time shifting behaviours they implemented had at least some impact on their daily routine, but only 5% of respondents reported having to substantially alter their daily routine (Figure 53). Over a quarter of respondents reported that they didn't need to change their daily routine to implement their energy saving/time shifting actions.

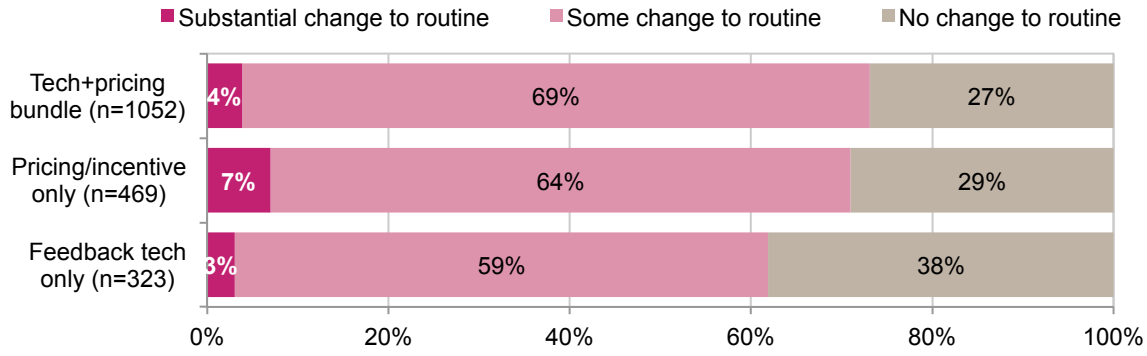
Figure 53: Magnitude of changes to daily routine



From responses to: "When thinking about the energy saving and/or time shifting behaviour changes you made, which of these statements best reflects your experience? I had to significantly alter my daily routine; I had to make some changes to my daily routine; I didn't really need to change my daily routine". (Q.C19; n=1877. 2014 responses only.)

When looking at the magnitude of the changes respondents made to their routines by type of product, the 'Feedback Technology only' group of products had a statistically significant larger proportion of respondents not making any changes to their routine (Figure 54).[57] This suggests that pricing signals/financial incentives that encourage reduced consumption at peak times were the main drivers of perceived change to daily routines.

Figure 54: Magnitude of changes to daily routine by product, technology and pricing type



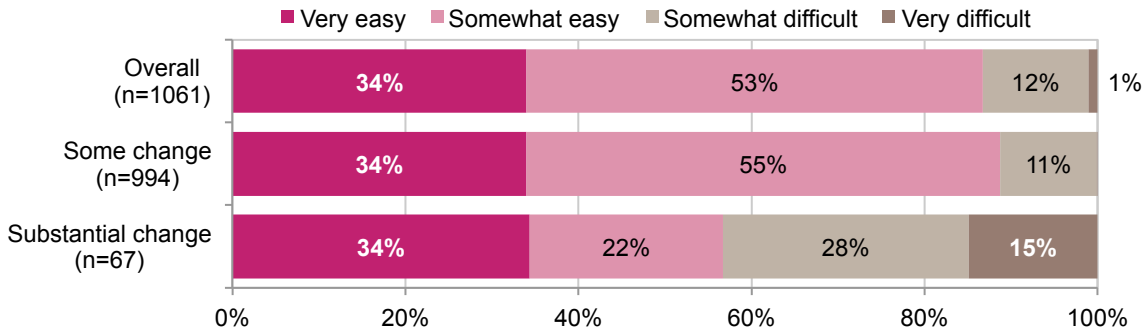
From responses to: "When thinking about the energy saving and/or time shifting behaviour changes you made, which of these statements best reflects your experience? I had to significantly alter my daily routine; I had to make some changes to my daily routine; I didn't really need to change my daily routine". (Q.C19; n=1877)

[57] Kruskal Wallis test, p<0.001

Respondents who reported altering their daily routine were asked to rate how easy or difficult it was to make these changes. Over 85% of respondents reported that the changes were somewhat or very easy (Figure 55). Not surprisingly, the cohort that reported making 'substantial changes' to their routine had a much higher proportion of people rating the changes as somewhat or very difficult (43% compared to 11% for 'some change').

No observable or statistically significant trends were apparent when looking at ease of change across product or technology types.

Figure 55: Ease of making changes to daily routine

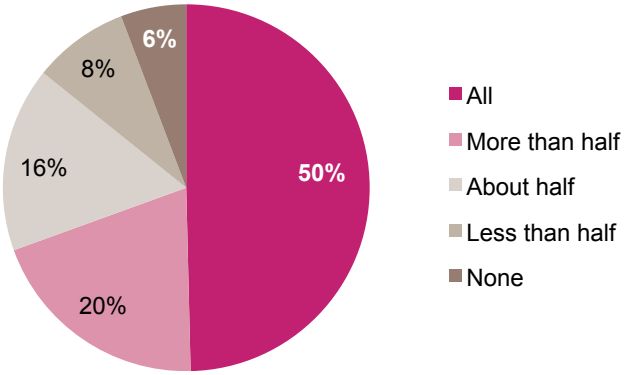


From responses to: "How easy or difficult was it to make these changes to your routine?" (Q.C19b, n=1061. 2014 responses only)

4.2.1.4 Persistence of behaviour change

Respondents were asked what proportion of the energy saving or time shifting behaviour changes they were still doing of those that they had started since using their product. The results shown in Figure 56 suggest that the changes in behaviour that respondents implemented were relatively persistent, with half of those undertaking changes reporting that they were still implementing *all* of their changed behaviours, and a further 20% reporting still implementing more than half.

Figure 56: Persistence of behaviour changes



From responses to: "Of the energy saving and/or time shifting behaviour changes that you just mentioned, what proportion are you still doing?". (Q.C20a; n=1834)

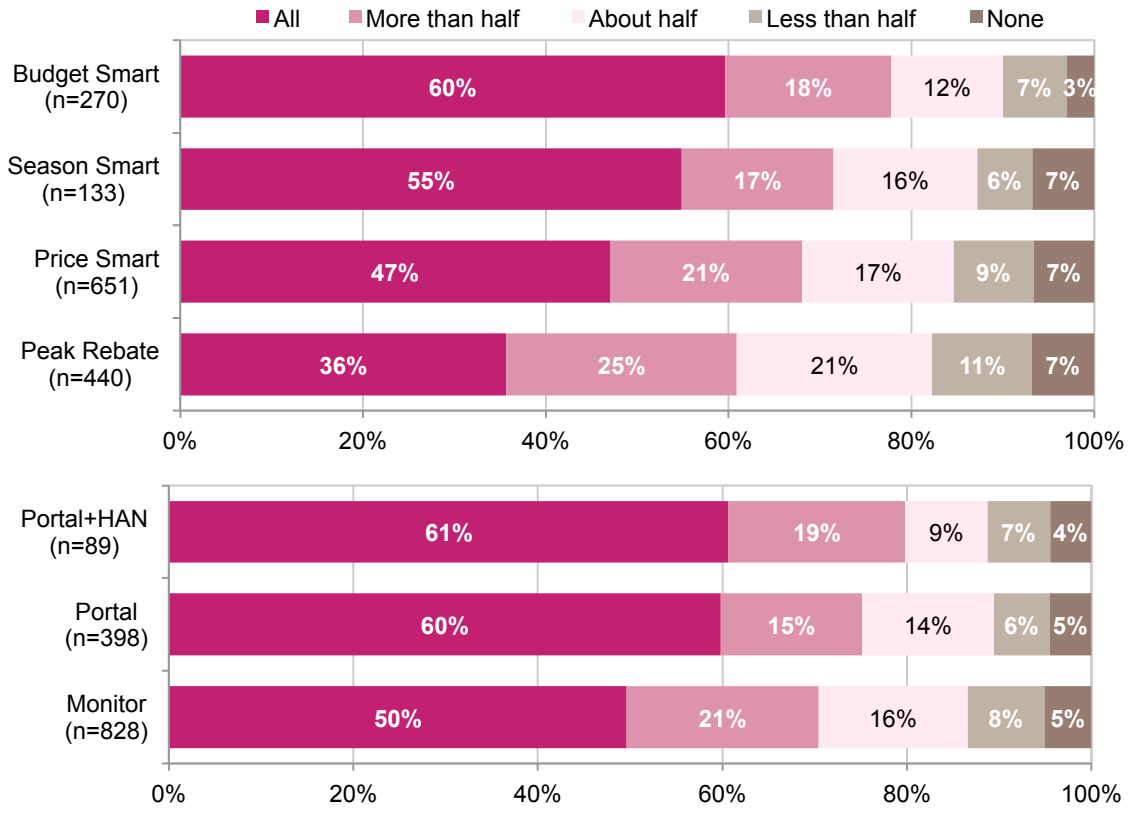
Statistically significant differences were found between the different pricing/incentive structures, and between the specific feedback technologies (Figure 57).[58] Within the

[58] Kruskal Wallis test: p<0.001

pricing/incentive types, the peak event products showed lower levels of persistence compared to the other time-of-use tariffs. This may be due to the interpretation of the question by peak event respondents who may not have had a peak event called in some time.[59] A potentially more reliable indicator of persistence for these peak event products is the question regarding interest in ongoing participation in peak events over time (see Figure 39).

Analysing by product types 1-3 and technology type showed those with 'technology only' products, and with portal and portal+HAN feedback devices showed the highest levels of persistence, but this result is so heavily influenced by the lower persistence of peak event products that these cannot be considered real results and are not shown in Figure 57. A multivariate analysis would be required to isolate the incremental impact of different technology versus tariff related factors, as noted in future research priorities (Section 6.2). Insufficient certainty in time-series household-level savings precluded the cross-referencing of this finding with estimated savings data.

Figure 57: Persistence of behaviour changes by pricing/incentive type

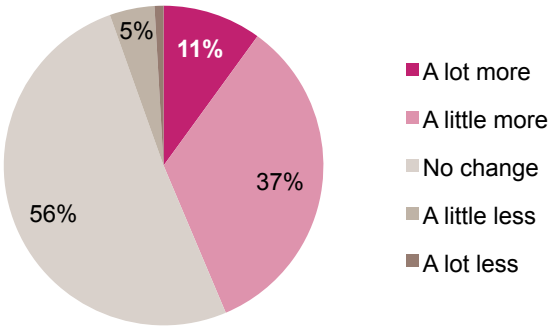


From responses to: "Of the energy saving and/or time shifting behaviour changes that you just mentioned, what proportion are you still doing?". (Q.C20a; n=1834)

Those participants who responded to both the 2013 and 2014 survey were asked to rate their perceptions of the persistence of their behaviour changes over the same period. Respondents were much more likely to say that they were doing more changes now than they were six months ago (48%) rather than less (6%).

[59] Note, however, that the retail trial explicitly chose to test customer fatigue by running events on successive days, particularly towards the end of the trial.

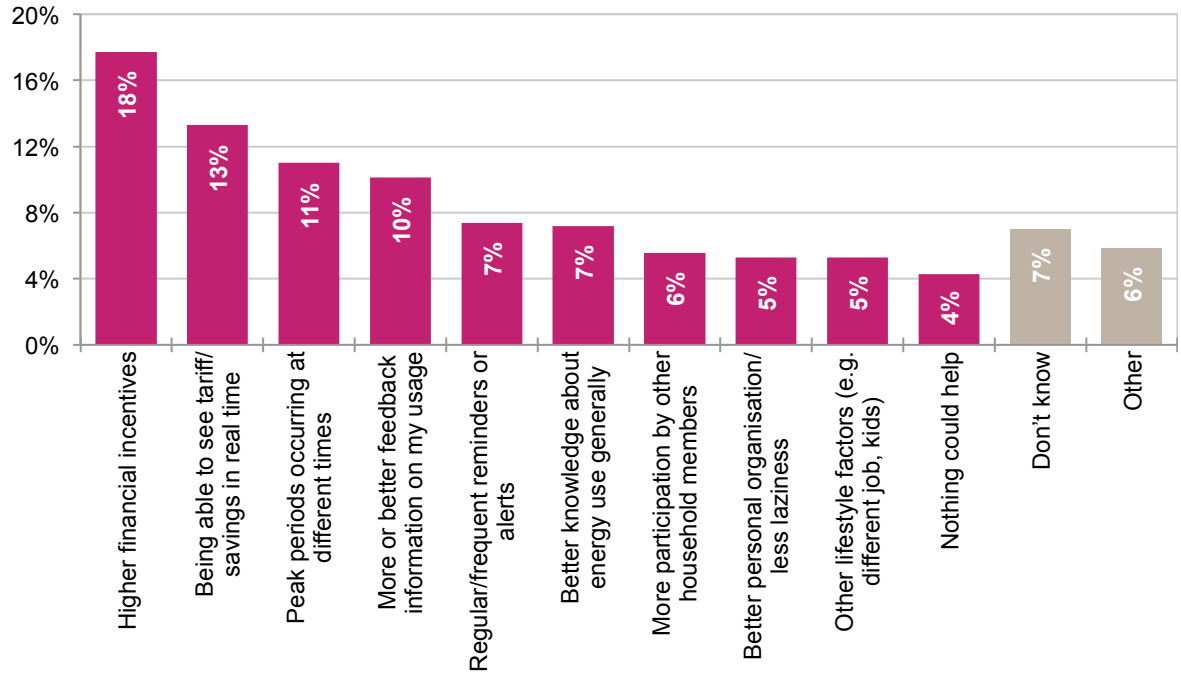
Figure 58: Persistence of behaviour changes over time



From responses to: "Do you think you are doing more or less of these behaviour changes now, than you were 6 months ago when you completed the first survey?" Q.C20ai; n=860. Repeat respondents only)

Participants were asked what would have assisted them to continue the behaviours they started and then stopped, and their responses are shown in Figure 59 and discussed below.

Figure 59: Factors that may increase persistence of respondent behaviour change



From responses to: "Of those behaviour changes that you started and then stopped, what would have assisted you in continuing with them?" (Q.C20b; n=745)

Eighteen per cent of respondents reported that **higher financial incentives** would have helped. This may reflect the interpretation by respondents who had peak event products (who only undertook changes during peak events) that if more events were offered, they would happily persist with their behaviour changes.[60]

The next two most common response categories (with 13% and 11% respectively) were **being able to see tariff/savings in near real time** and **peak periods occurring at different times.** Those in the former category were likely customers on products with a

[60] 65% of people who chose this reason were on a peak event product.

monitor or no feedback technology, or customers on network products, as this feature was included for retail portal customers. Those in the latter category were generally those respondents for whom slightly shorter (for example, by 0.5 to 1 hour) or different peak periods might have helped them to continue their behaviour changes. From a utility perspective this change would be difficult to implement routinely, but in an environment of more targeted, responsive real time pricing with feedback to users, this may be a strategy to use to encourage more and longer lasting behaviour changes.

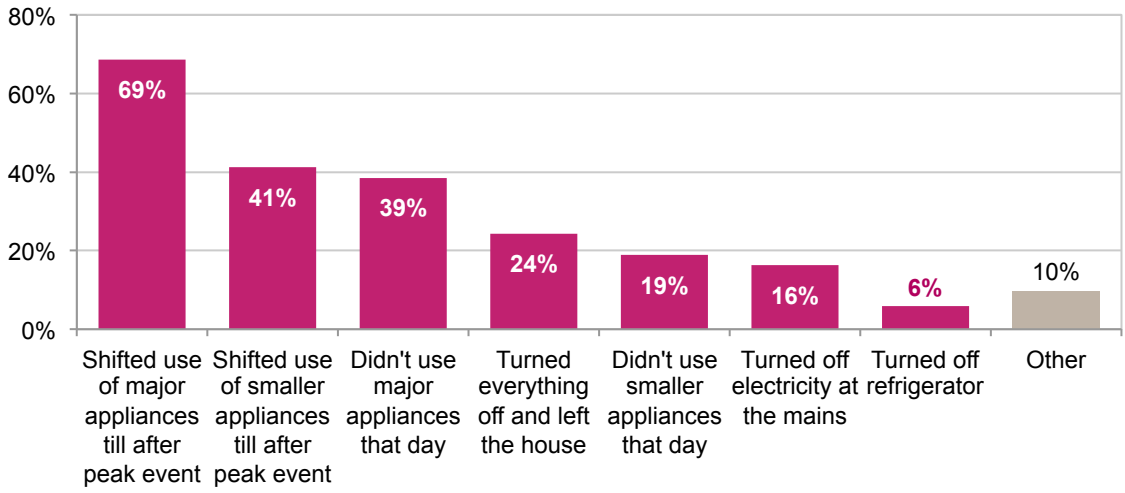
Smaller proportions of respondents said the following measures would have helped them to persist with their energy-saving behaviours:

- More **regular reminders** or alerts on their feedback products that prompted them to make use of load shifting or energy saving opportunities during peak periods
- More or **improved information on energy usage**, anecdotally relating to respondents wanting more functionality than the product they trialled could offer (e.g. appliance-specific real time usage information), which other products in the trial did in fact offer
- **Improved energy literacy** generally, and better knowledge of the timing of peak periods.
- **Broader participation** from all rather than just one or two householders. For example, numerous respondents reported partners or children being hard to get involved.

4.2.1.5 Peak event behaviour change

As discussed in Section 4.1.3.1.1, 87% of respondents with a peak event product reported that they participated in at least one peak event. These respondents were asked whether the nature of the behaviour changes they made during these events differed from changes made at other times (Figure 60). The results indicate that for almost 70% of respondents, peak event behaviour changes involved shifting the time of their usage outside the peak event for the largest energy using appliances in their home. Forgoing appliance usage completely on that day was also common for large (39% of respondents) and small appliances (19% of respondents). Interestingly, almost a quarter of all participating households turned off all appliances and left the premises during peak events.

Figure 60: Actions undertaken during peak events

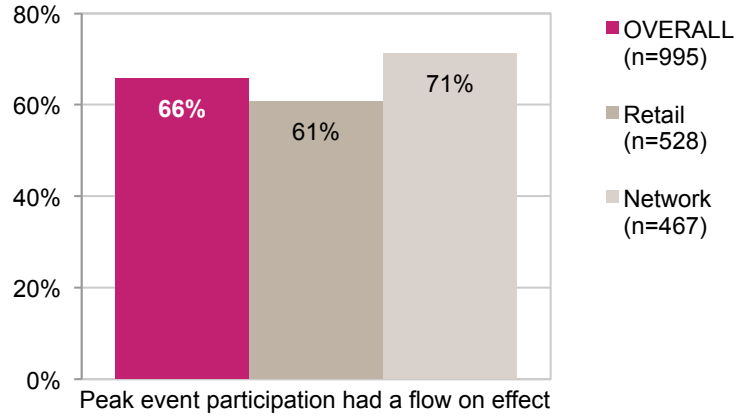


From responses to: "Which of the following actions did you undertake on days on which the peak events occurred?" (Q.C18d; n=848) Respondents could choose multiple options so percentages do not sum to 100%.

Note that analysis of actual savings in Section 5.3.1.4 finds that those who 'turned everything off and left the house' during the peak event had statistically significantly higher peak savings than other actions.

When asked, two-thirds of respondents reported that their participation in peak events had the flow-on effect of reducing their electricity use at other times (Figure 61). As with participation in peak events (Section 4.1.3.1), the Network Peak Rebate performed slightly better in this respect than did the Retail Peak Pricing, with 10% more network respondents reporting continued behaviour change outside of the peak events.

Figure 61: Self-reported behaviour change subsequent to peak events



From responses to "Has participating in the peak event(s) had an effect on reducing how much electricity you and the other people in your home use at other times?" (TQ.C5d1; n=995) NB. Only for respondents who answered 'Yes' to C5d Participation in Peak events.

4.2.2 Energy awareness, control and literacy

4.2.2.1 Effect on energy awareness, control and literacy

Participants were asked how the use of their product had impacted on the following six factors:

1. Awareness of electricity use ("Awareness")
2. Control over electricity use ("Control over use")
3. Ability to reduce electricity bills ("Reduce bills")
4. Ability to budget your electricity use ("Budget")[61]
5. Ability to evaluate the costs and benefits of pricing structures offered by electricity companies ("Evaluate")
6. Confidence in responding to new offers from electricity companies ("Participate").

Unsurprisingly, very few respondents (generally in the order of 3–4%) reported that the trials resulted in a decrease in any of these measures of energy awareness, control or literacy (Figure 62).

The first three factors above would be expected to present a 'cascade' of user empowerment, in that the first stage of empowerment is the provision of information leading to raised awareness, which hopefully leads to a greater sense of control over electricity use, which ideally should translate into reduced bills.

[61] For respondents with BudgetSmart products (R1-R4) only

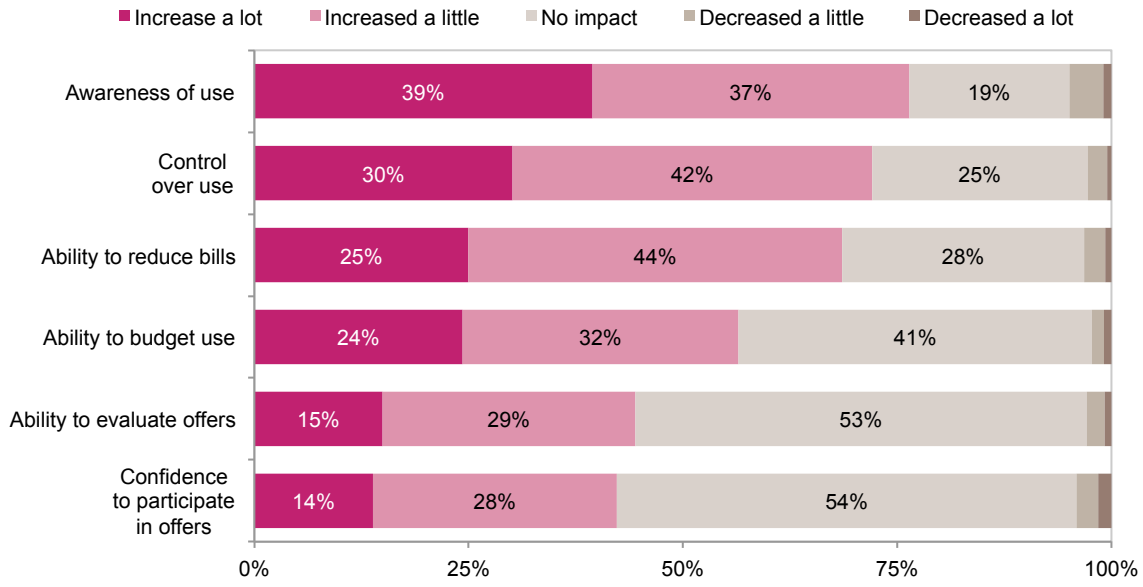
The results shown in Figure 62 represent this cascade. Improvement in “awareness” was the strongest, with over three-quarters of respondents reporting an increase in awareness of their electricity use as a result of trialling their product (39% a large increase, and 37% a small increase).

A slightly smaller proportion, at 72%, reported an improved sense of control over electricity use, and a slightly smaller proportion again (69%) felt they were able to convert their increased control over consumption levels into reduced bills. The difference between the 76% who improved awareness and the 69% who felt able to reduce bills reflects a relatively small 7% of respondents for whom there was a disconnect in translating awareness into practical action to reduce bills.

This is a positive outcome, suggesting that the trialled products were able to provide the tools necessary to deliver consumer empowerment.

Looking beyond awareness and control of energy use, to measures of energy literacy (i.e. a broader understanding of how the electricity system works and how it affects customers), it was found that less than half of the respondents reported that the trials increased their ‘ability to evaluate costs and benefits of pricing structures’ (44%) or their ‘confidence in responding to new offers’ (42%), while over 50% said the trial had no impact. Thus while the trialled products did achieve positive results, an understanding gap remains for many consumers when it comes to complex energy offers.

Figure 62: Overall impact of product use on energy awareness, control and literacy



From responses to: “Please indicate what effect your product has had on each of the following: Your awareness of your electricity use; Your control over your electricity use; Your ability to reduce your electricity bills; Your ability to budget your electricity use; Your ability to evaluate the costs and benefits of pricing structures offered by electricity companies; Your confidence in responding to new offers from electricity companies”. (Q.C15; n=2313, Q.C15.4; n=354) NB. Only respondents with the BudgetSmart Plan (Products 10-13) were asked about Statement 4 – Ability to budget use.

There were no statistically different demographic differences (i.e. language, income, household ownership, historical energy consumption, etc.) in responses to these questions.

4.2.2.2 Change in energy awareness, control and literacy by product

Statistically significant differences were found in awareness, control and literacy according to the product code (individual products). Significant differences were also found when looking at results by Product Type, Pricing/Incentive Type and Technology Type.[62]

Figure 63 shows the same results as in Figure 62 but by individual product. Products in Figure 63 are ordered highest to lowest based on the average respondent score for Awareness (A), Control over use (C) and Ability to reduce bills (R) (three of the six included factors of energy awareness, control and literacy).[63] The results show the clear dominance of Type 3 combination products (with labels colour-coded pink on the left of the graph) over both Type 1 pricing/incentive only (grey labels on left) and Type 2 technology only (orange labels on left). The best performers were Type 3 peak event products (PriceSmart and Network Rebate) and Type 3 Portal+HAN products, which show a very strong association between awareness and empowerment to act.

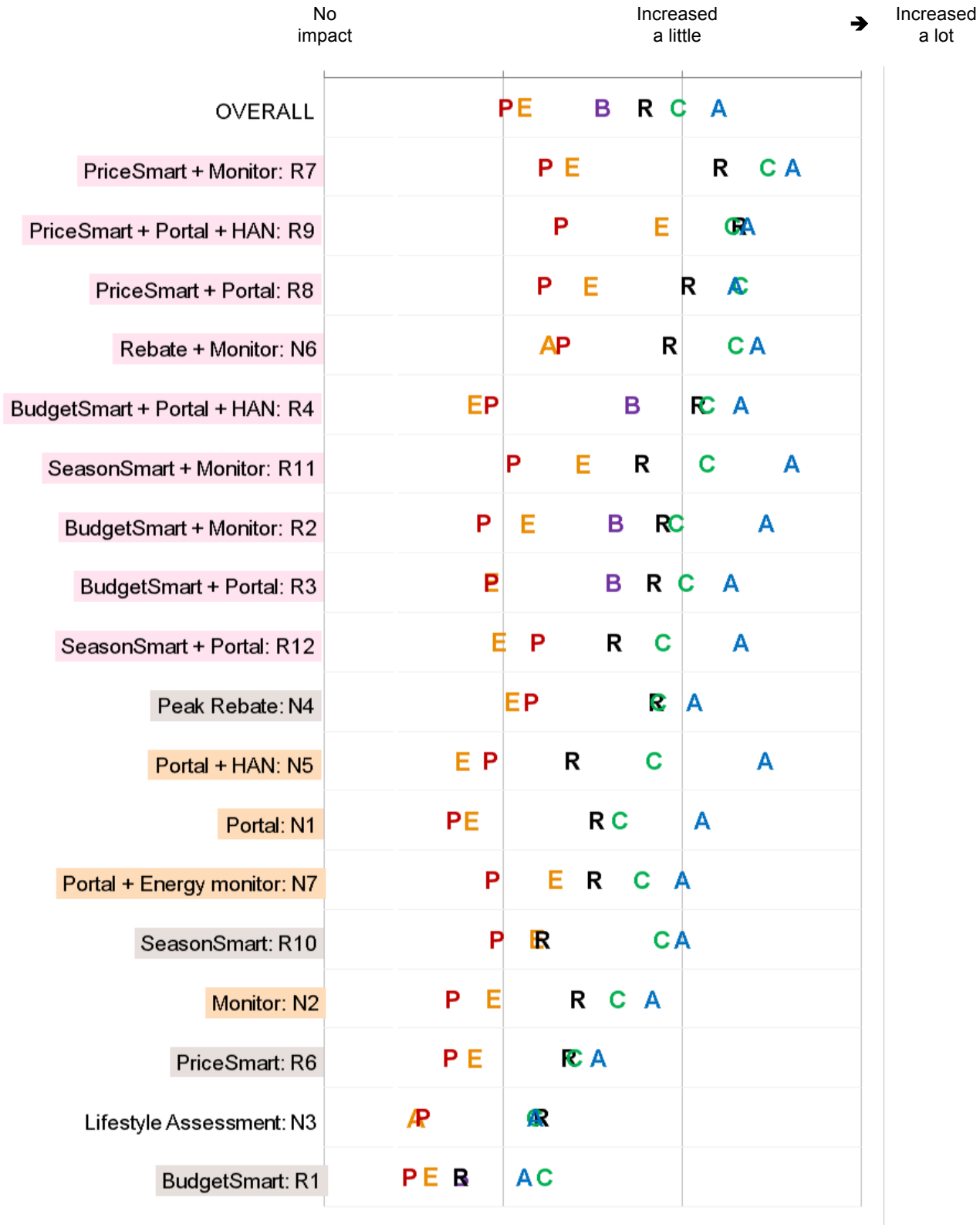
It is interesting to note that when not combined with a feedback technology, the retail tariff products (PriceSmart, BudgetSmart and SeasonSmart) performed close to the worst out of the group, suggesting the important role feedback technology plays in improving customers' awareness, control and literacy.

[62] *Kruskal Wallis test, p<0.001 (Awareness, Control, Reduce, Evaluate, Participate), p=0.042 (Budget).*

[63] Ability to evaluate (E) and participate (P) in market offers was not considered critically linked to product type, and thus these results are shown on the graph but do not affect the ordering of products.

Figure 63: Impact of product use on energy awareness, control and literacy, by product

Key: Awareness Control Reduce Budget Evaluate Participate

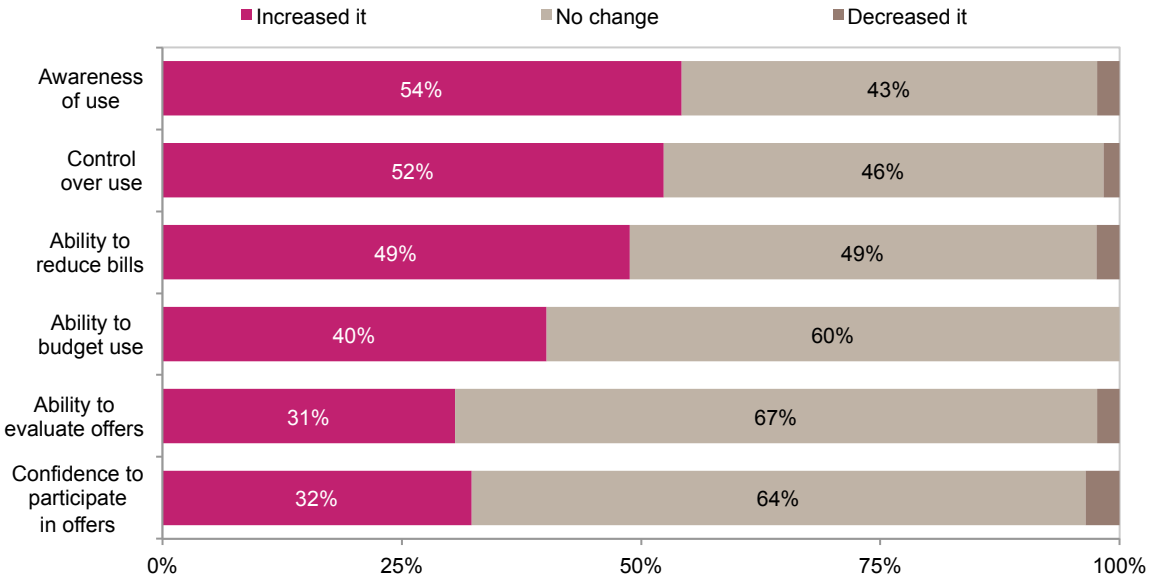


Above figure is from responses to: "Please indicate what effect your product has had on each of the following: Your awareness of your electricity use; Your control over your electricity use; Your ability to reduce your electricity bills; Your ability to budget your electricity use; Your ability to evaluate the costs and benefits of pricing structures offered by electricity companies; Your confidence in responding to new offers from electricity companies". (Q.C15; n=2313, Q.C15.4; n=354) NB. Only respondents with the BudgetSmart Plan (Products R1-R4) were asked about Statement 4 – Ability to Budget use.

4.2.2.3 Change in awareness, control and literacy over time

Respondents who had completed the earlier survey in 2013 were also asked to estimate how their levels of awareness, control and literacy had changed specifically in the last six months since the previous survey. Responses in Figure 64 show a similar pattern to Figure 62 but with somewhat less people reporting the various elements having continued to increase in the last six months and more people reporting no change. This suggests that respondents see the benefits of their product in these areas accruing more at the beginning of their usage, with diminishing returns over time.

Figure 64: Perception of change in energy awareness, control and literacy over time



From responses to. "Now specifically in the last 6 months (since you completed the first survey), how has the continued use of your product changed the following? Your awareness of your electricity use; Your control over your electricity use; Your ability to reduce your electricity bills; Your ability to budget your electricity use; Your ability to evaluate the costs and benefits of pricing structures offered by electricity companies; Your confidence in responding to new offers from electricity companies" (Q.C15a; n=817, C15.4 n=220) NB. Only respondents with the BudgetSmart Plan (Products 10-13) were asked about Statement 4 – Ability to budget use.

4.2.3 Bill savings

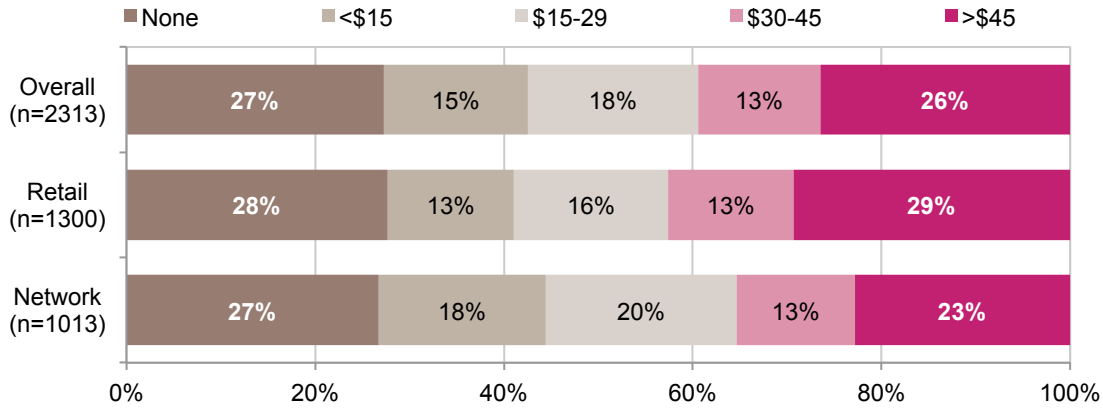
4.2.3.1 Perception and expectations of bill savings

Participants were asked 'how much money do you think you saved off each electricity bill during the trial?' Just over a quarter of respondents overall perceived that the product had not saved them any money, while a similar proportion felt they had saved in the highest

bracket of over $45 per bill,[64] which would represent a reduction of around 10% of the average quarterly bill (Figure 65).

While the proportion of respondents believing they had saved no money was the same between Retail and Network trial respondents, of those who did perceive savings, a higher proportion of Retail respondents perceived they had gained savings in the highest bracket than Network respondents.

Figure 65: Participant perception of savings from trial

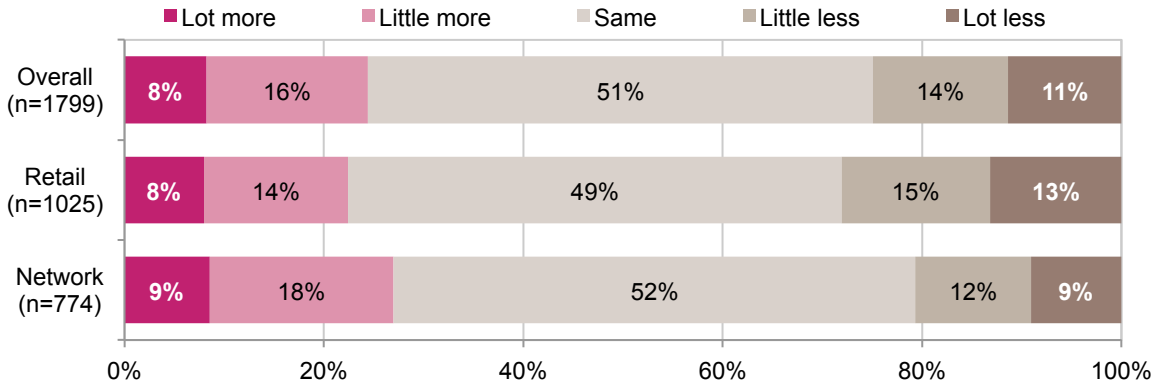


From responses to: "How much money do you think your product saved you off each electricity bill during the trial?" (Q.C14, n=2314)

Participants in the 2014 survey were also asked whether this perception was in line with how much they expected to save. Half of all respondents felt that their savings met their expectations (Figure 66). The remaining half was split equally between those who felt their savings were above expectations and those whose were below.

Interestingly, despite a higher proportion of retail respondents perceiving higher savings compared to network respondents, a slightly higher proportion of retail respondents still felt that their savings were lower than they expected (28% compared to 21%). It thus appears that to some extent, the alternative tariff structures offered in the retail trials led to higher expectations of savings.

Figure 66: Participant savings from trial compared to expectations



[64] Amongst 2014 survey respondents, of the roughly one-quarter of participants who believed they had saved more than $45, 54% of these indicated they thought their savings were between $46-$100, while 46% believed their savings were greater than $100 per bill.

From responses to: "Were the rebates /savings you achieved more, less or about the same as you anticipated?" (Q.C14a, n=1799. 2014 respondents only)

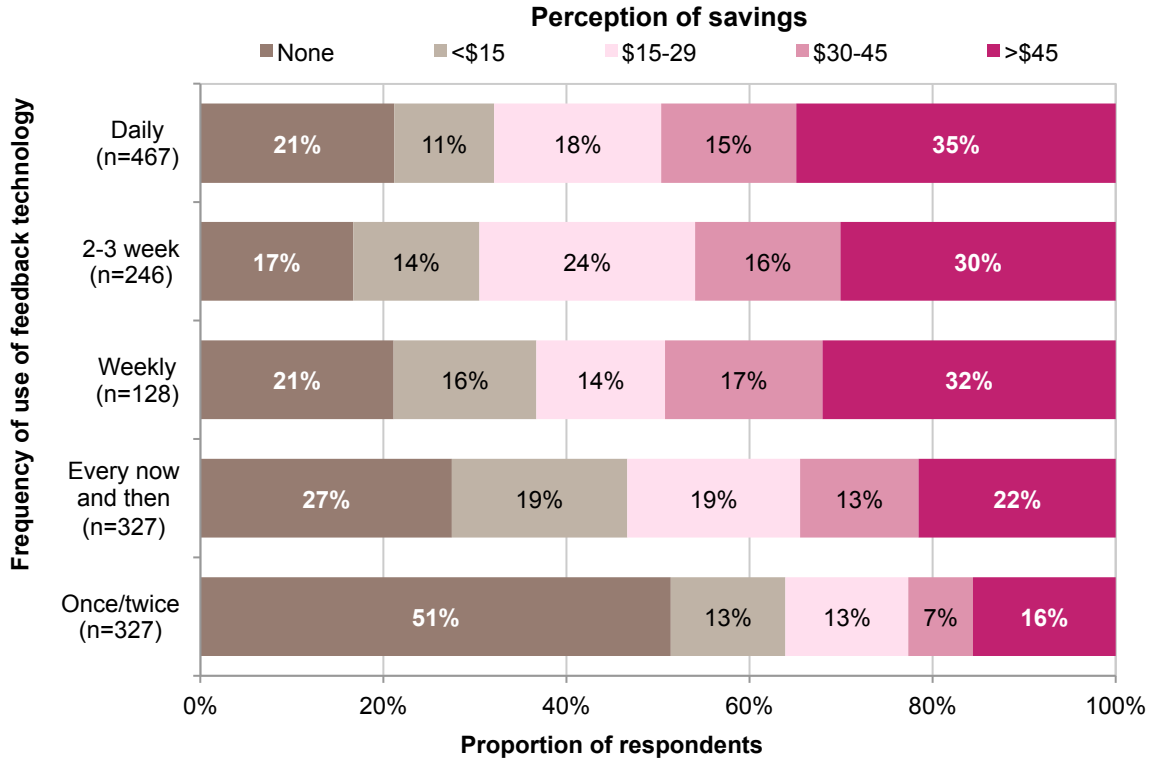
Not surprisingly those who perceived lower savings more often stated that their savings were below expectations, while the opposite was also true, with those who perceived higher savings more often stated their savings were above expectations. However, even some respondents with perceived savings at the higher end felt that their savings were below what they expected.

Refer to Section 5.3.2.1 for analysis of actual versus perceived bill savings.

4.2.3.2 Perceptions of savings by feedback usage

When the data on perception of savings was analysed with respect to how often those same respondents used their feedback technology, a general trend of decreasing engagement and decreasing level of perceived savings was observed (Figure 67 below). This association was statistically significant.[65] This reinforces the importance of ongoing engagement with feedback data in delivering customer benefits.

Figure 67: Frequency of use of feedback technology versus perception of savings



From responses to: "How much money do you think your product saved you off each electricity bill during the trial? (TQ.C14; n=1420), broken down by responses to "How often do you use the [feedback product] that you are trialling?" (TQ.C2; n=1344)

4.2.3.3 Perceptions of savings by product type

Looking at perceptions of savings by product type, similar to other questions, this saw tariff and technology and tariff-only products outperform technology-only products, with over 40% of respondents reporting they saved more than $30 per bill. By technology type,

[65] Chi-squared test, p<0.001.

Portal+HAN product respondents reported the greatest savings, followed by those with monitors. Looking at perceptions of savings by product, the peak event and BudgetSmart products performed well, and the Peak Rebate particularly, with between a half and third less respondents reporting they saved nothing, compared to the other products. These differences were statistically significant[66] and the results are presented in Appendix 7.3. These are the same products that rated highly for increasing respondents' awareness, sense of control and ability to reduce electricity use (see Figure 63 above).

It may be that this is an accurate reflection of the value of the dynamic pricing/incentive products, or it could be that the savings that these products generated were more tangible to customers. This could feasibly be the case for the Peak Rebate, which involves participants receiving a lump sum rebate following each peak event, rather than having to scrutinise differences over time on a bill where savings may have been obscured by other factors. Greater tangibility of savings could stem from the BudgetSmart product, which involves more active user engagement with bill estimates and budgeting over time, rather than just at the quarterly billing cycle.

[66] These differences were statically significant. Kruskal Wallis test, $p<0.001$.

4.3 PRODUCT CONCLUSIONS

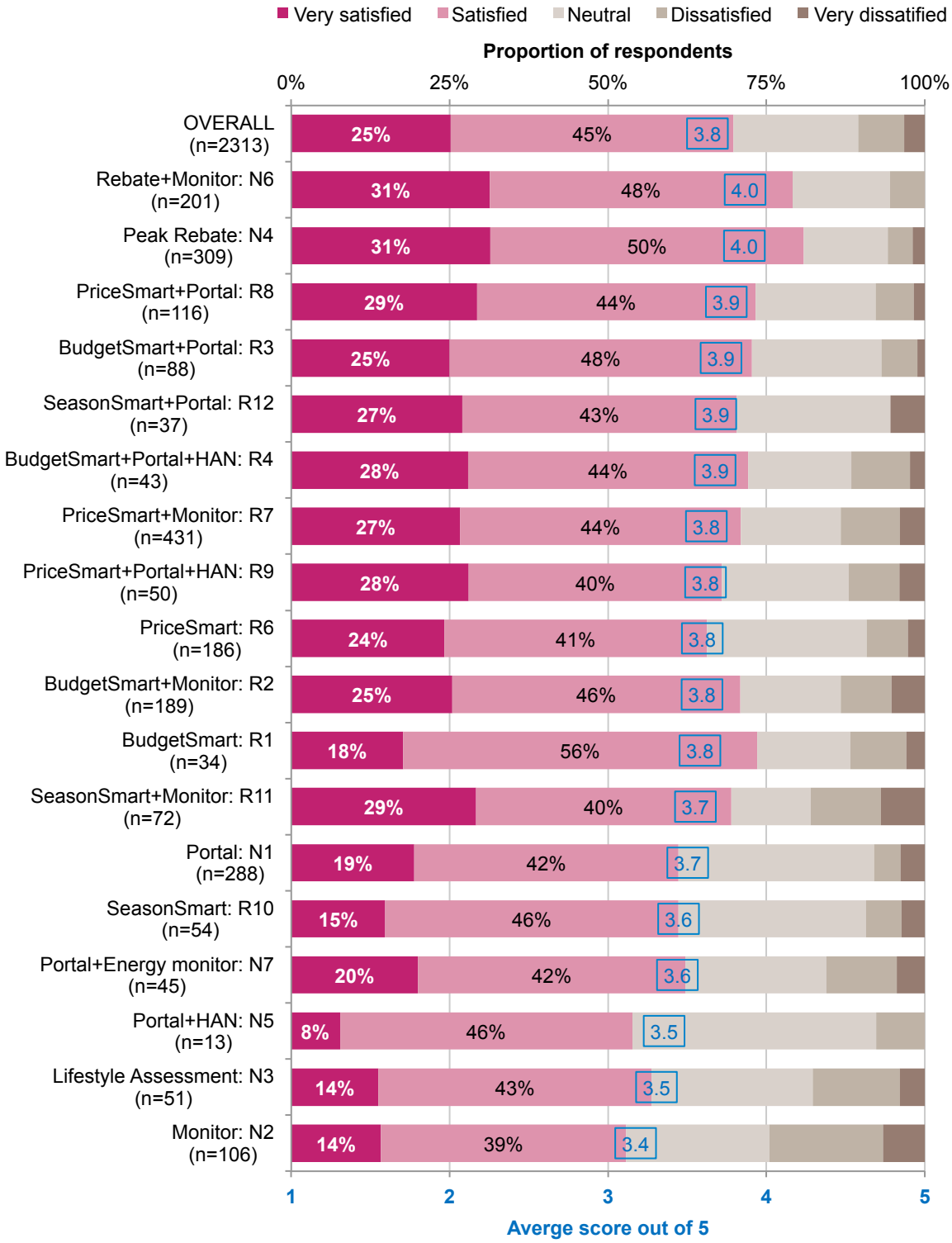
4.3.1 Product satisfaction

Overall the majority of respondents were positive about the product they had trialled, with 25% reporting that they were 'very satisfied' and 45% 'satisfied', and only 10% of respondents were dissatisfied or very dissatisfied (Figure 68). Most products were viewed very positively, with the two peak rebate products (N4 and N6) receiving the highest average scores. The Network product consisting only of the home energy monitor received the lowest average satisfaction rating.

Statistical analysis of the results shown in Figure 68 below revealed that amongst the three product types, Type 3 combination products performed best, and amongst the pricing/incentive types peak event products were best, followed by BudgetSmart. No statistically significant difference was found between technology type.[67]

[67] Kruskal Wallis test, $p<0.001$.

Figure 68: Overall satisfaction with product[68]



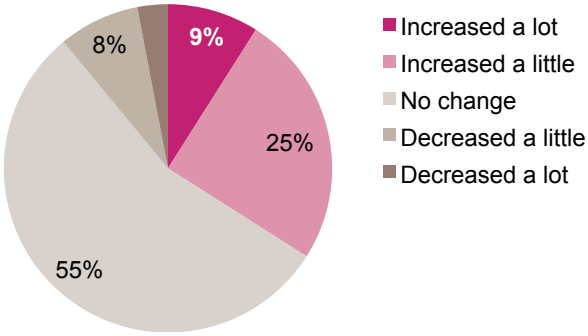
From responses to: "Overall, to what extent would you say you are satisfied with the performance of your product?" (Q.C16; n=1420)

[68] An average score was created for each product type by assigning a value of 1-5 to the five responses (with 1 = 'very dissatisfied' and 5 = 'very satisfied').

Those respondents who responded to both the 2014 and 2013 survey, were asked to rate their perception of the change in their satisfaction over the same period. Respondents were more likely to say that their satisfaction had increased a lot or a little (34%) than to say it decreased a lot or a little (11%).

That is, the opinion respondents formed of their product after a relatively short period of use tends to remain relatively accurate in the majority of cases, with a slight tendency to improve over time rather than decline.

Figure 69: Change of product satisfaction over time



From responses to: "How do you think your level of satisfaction with your product [P_S] has changed over the last 6 months, since you completed the first survey?" (Q.C16; n=817).

Participants were invited to explain why their satisfaction changed over time. Table 12 provides a summary of the reasons given.

Table 12: Reason for change in satisfaction

Reason	Prevalence
Increase in satisfaction	
Learning: Increased awareness of costs and electricity use, Learnt what to expect and it was manageable, Increased capacity to manage energy use, Awareness of benefits to the community, After time learnt what to expect and then interest increase	55%
Saw impact: Saved money, Reduced energy use, Reduced environmental impact, Maximum benefit achieved at the start	22%
Accessibility: Easy to use, increasing familiarity, reminder text messages	7%
Service/product improved over time: Stopped getting balance texts, Online portal improved, Product reliability increased, Received help eventually - wasn't working at start, Became easier with time, On-going feedback increased with time	6%
Satisfaction remained the same	
Lacked substantial impact: Consistent electricity use, Initial learning then nothing new, Already aware of most of the info provided, Caused no behaviour change, Needed more information	34%
Expectations / experience consistent: Product experience didn't change, Easy to use/satisfied from the start, Product didn't change /familiarity, Always been a reliable and useful tool	32%
Didn't use it at all/often: Saw no benefit/reason in using it, Just didn't use it, Lack of interest, Lack of time, Not home often, Forgot, Don't know how to use it	10%
Product/service issues: Trouble logging on, Computer unavailability, Unreliable data, Not working all the time, Poor customer service/difficult getting issues fixed	9%

Decrease in satisfaction	
Product/service issue: Poor customer service, Product needed charging all the time, Difficulty using it, Not working correctly, Not practical to use	48%
No continuing impact: Benefits only significant at the start, No significant savings, Limited increase in knowledge over time, Couldn't decrease consumption	18%
Data: Anticipated more useful data, Data unreliable, Desire for more frequent / up to date data	16%
Peak events/prices: Can't avoid using electricity during peak times, Peak events inconvenient, Pressure to put health problems at risk to avoid using energy during peak times	13%
Lost interest: Felt conned into installing the smart meter, Annoying, Got bored, Lost interest as financial savings decreased, Lost confidence	9%
Electricity bill: Bills higher than expected, Sceptical of bills, Only had bill estimates - meter was not read, Disliked the upfront bill payment, Penalised for paying bill on time	8%

When looking for statistical association of respondent demographics with product satisfaction, the following statistically significant findings were made:

- **Language:** Those with English as their first language were more likely to be very satisfied, but overall levels of satisfaction and dissatisfaction were similar.
- **Understanding product benefits:** Product satisfaction levels were higher for those who state they understand the benefits of their product, know how to obtain the benefits of their product and received enough information to take advantage of their product.[69] Whether this was a cause or effect is unclear.
- **Level of engagement with feedback technology:** Those who engage more with their feedback technology were more likely to have higher levels of satisfaction. Again causation cannot be concluded from this result, as some other factor (such as technical problems) could be influencing both elements.

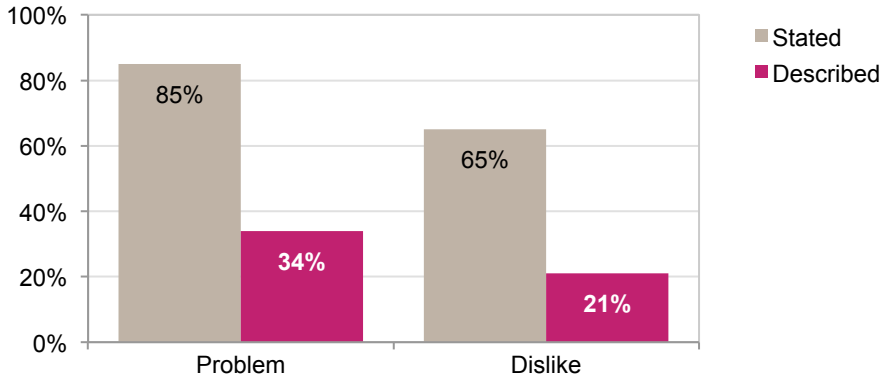
No statistically significant associations were found between overall product satisfaction and any of the following: Income, Home ownership status, Level of energy usage.

4.3.2 Product problems and dislikes

Despite the overall high levels of satisfaction with the products trialled, most respondents were able to nominate problems (85%) and/or things they didn't like (65%) (Figure 70). However, only a much smaller number of respondents cared enough to describe the problem (34%) or dislike (21%).

[69] Kruskal Wallis test, $p<0.001$.

Figure 70: Proportion of respondents noting problems/areas for improvement



From responses to: "Did you have any technical problems or faults with your product? If yes, what were they?" (Q.C9c; n=2271) and "Were there any aspects that you didn't like about your product? If yes, what were they? You may choose one or more of the following options, or describe under 'other'." (Q.C9d; n=2313) Note: Some respondents indicated that they had a technical fault with their product, but their qualitative answer described a dislike, and vice versa.[70]

The most common faults reported related to either the Monitor or the Portal as discussed below. The main problems reported for each technology and pricing type are indicated in Table 13.

Monitor problems

Around a third of respondents who received a monitor complained that the monitor did not work. This tended to relate to one of two main complaints, batteries not lasting or energy consumption not registering.

Online Portal Problems

Some of those that used the Online Portal had issues logging into the system, particularly in terms of incompatibility issues with Chrome and Firefox browsers. Some people wanted the portal to be able to examine data in more detail, particularly historic data rather than just data for the past two days. The latter may well be a participant misunderstanding, in that the portal can only show information from the date that it was connected. Thus historical data would be available after a longer period of use. This should be made clear to all respondents in the product information provided should this functionality not be available.

[70] The full set of qualitative responses to both questions are provided in the data available through the Information Clearing House.

Table 13: Commonly reported product problems and dislikes

Product	Common problems	Common dislikes
General	• Problems with smart meter functioning/connection • Inaccurate readings by smart meter	• More expensive bills regardless of effort/actions • Not being able to see savings on the bill • Issues getting technical fault fixed, including have to pay for technician visits • Getting too much, or alternatively, not enough information at the start of the trial • Wanting features that belonged to other products
Technology Type		
Portal	• Problems logging into portal • Portal running slow/crashing • Data was not updating	• Wanted access to a mobile version (NB: option was available) • Wanted to be able to download or save the data offline • Difficult to find where desired information was located in the portal
HAN	• Smart plug failure	• None
Monitor	• Losing network reception • Constantly froze had to be reset • Poor battery life • Incorrect readings/data	• Difficult to get the monitor to show the desired information (including that buttons were difficult to use)
Pricing/Incentive Type		
Peak Rebate	• Difficulties receiving/activating/using card • Rebates not showing correctly or in timely manner	• Timing of peak periods • Number and frequency of events • Difficulty understanding how rebates were calculated (Peak Rebate only)
PriceSmart	• No notification of peak event	• Timing of peak periods
SeasonSmart	• Prices unknown	• None
BudgetSmart	• Incorrect text messages	• Complaints about the number of SMS/emails received • Paying account in advance

Note: No specific comments were received for Lifestyle Assessment.

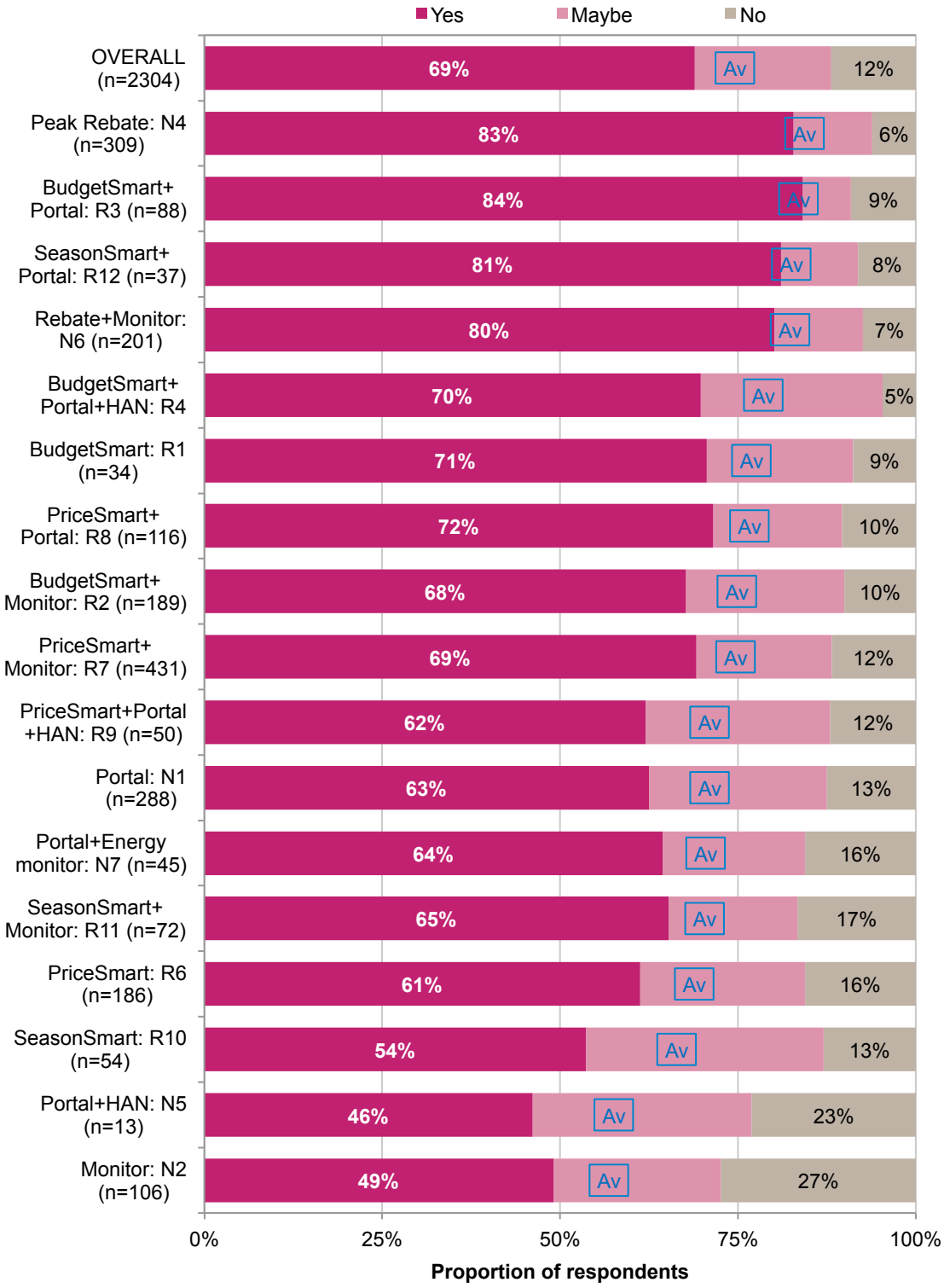
4.3.3 Continued use of product

Overall, 69% of respondents were interested in continuing to use their product if it were to be available in the future. This was similar to the proportion of respondents who were satisfied with their product. A further 19% reported that they may be interested in continuing. Only 12% of respondents said they would not be interested in continuing to use their product.

The two peak rebate products (N4, N6), plus BudgetSmart+Portal (R3) and SeasonSmart+Portal (R12) recorded the highest proportions of respondents interested in continuing to use the product. As with overall satisfaction, the product consisting only of the home energy monitor had the lowest proportion of people definitely or potentially wanting to keep using the product. The products that consist only of a feedback technology all fall in the bottom half of products, while (with the exception of N4 Peak Rebate and R1 BudgetSmart) all of the products in the top half consist of products combining technology with a pricing/incentive. Note: as per Product Satisfaction, the above result was statistically significant for product type and pricing/incentive type, but not for technology type, suggesting that it was the presence of tariffs that increases desire to continue to use.[71]

[71] Chi-squared test, $p<0.001$ (Product Type, Pricing/Incentive type, Individual Product).

Figure 71: Proportion of respondents who would continue to use product



From responses to: "The following question does not commit you to anything, and is just to help us gauge if your product was useful. If your product was available as an option from your energy provider would you be interested in using this product again?" (Q.D2; n=2304) NB: Respondents with Product N3 Lifestyle Assessment were not asked this question.

No demographic factors (i.e. language, income, household ownership, historical energy consumption, etc.) were identified as having a statistical association with desire to continue to use.

When considering the high number of respondents who reported that they were interested in continuing to use their product, it must be remembered that a number of participants had already opted out of the trial, and as such are not represented in the numbers above. In fact, 17% of respondents permanently stopped using their product during the period of the trial.

The most common reasons provided for customers opting out of the trial were 'moved house', 'product didn't work' and 'didn't save money'.

4.3.4 Likelihood of recommending product

In addition to rating their level of product satisfaction and interest in continuing to use their product beyond the end of the trial, respondents were also asked to rate the likelihood of recommending their product to others by giving a score of 1–10.

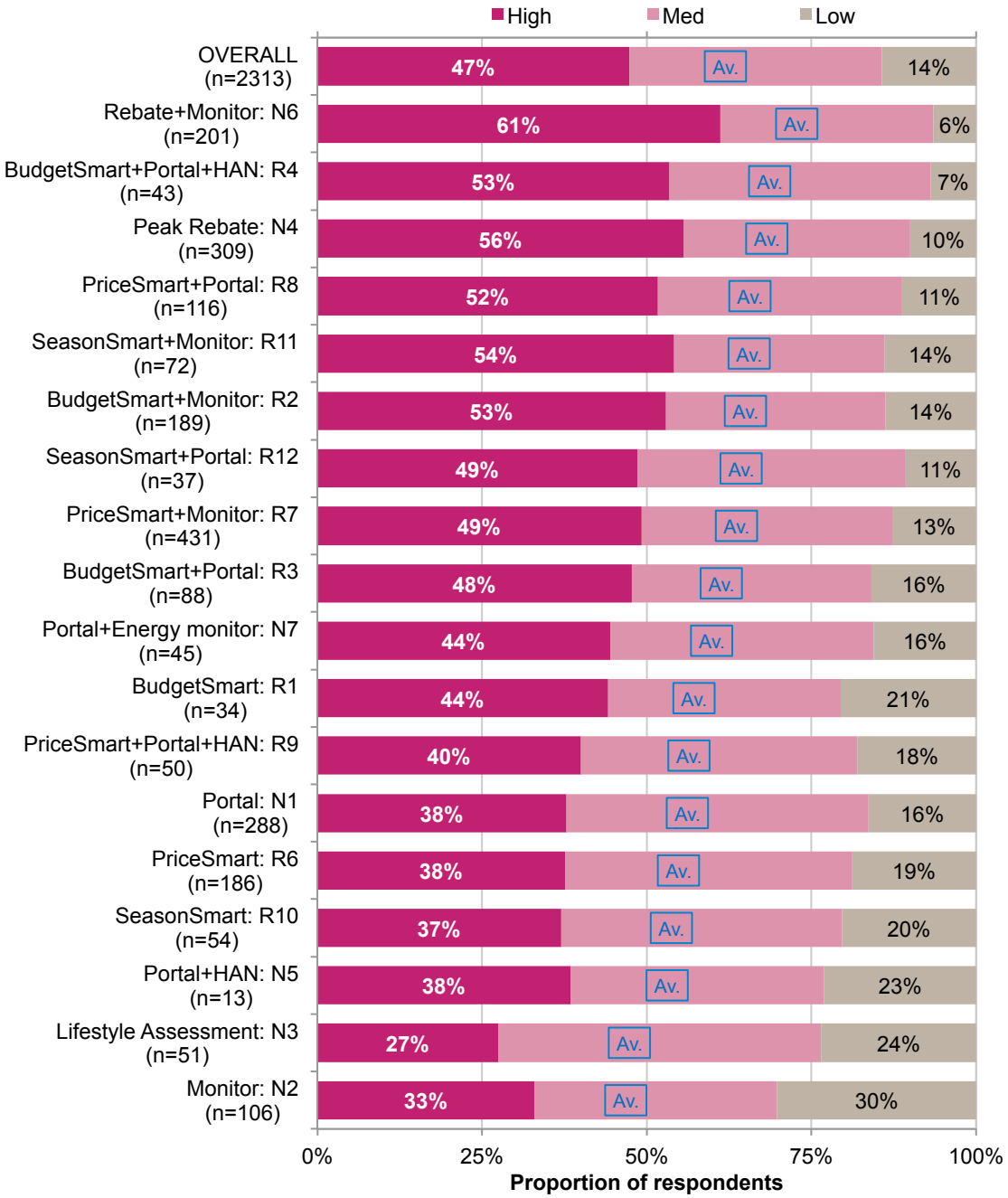
When these scores were categorised as low likelihood (1–3), medium likelihood (4–7) and high likelihood (8–10), almost half (47%) of respondents rated their likelihood of recommending their product as high, while another 38% rated the likelihood as medium (Figure 71).

By product, these results closely reflect those seen in the 'Continue to Use' section above, with the two peak rebate products (N4, N6) performing strongest, and combination products (Type 3 products) outperforming tariff-only or feedback-only products.

A comparison of the mean score (out of 10) showed statistically significant differences according to Product Type and Pricing/Incentive Type.[72] Products that combined a feedback technology with a pricing/incentive had the highest mean score, followed by pricing/incentive-only products. Feedback technology-only products had the lowest scores. Within the Pricing/incentive-only products, the Peak Rebate product's average score out of 10 was higher than the Retail tariff products' average scores out of 10.

[72] Anova test, $p<0.001$.

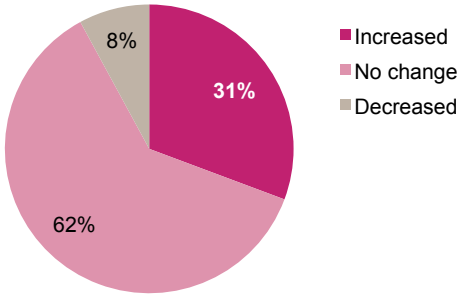
Figure 72: Likelihood of recommending to others



From responses to: "On a scale of 1-10 where 1 is extremely unlikely and 10 is extremely likely, how likely are you to recommend the product to a friend?" (Q.D1; n=2313)

Respondents to the 2014 survey who had completed 2013 survey were also asked to estimate the change in their likelihood to recommend over the six months since the last survey. Almost two-thirds (62%) of these repeat respondents reported that their likelihood to recommend had not changed over this six-month period, while almost another third said it had increased (Figure 73). Less than 1 in 10 said their likelihood to recommend had decreased over the past six months. This is a very positive finding for smart grid products generally and, when coupled with similar findings for product satisfaction (refer back to Figure 69), suggests that there was little decline in customer perceptions of the products after 6–12 months of use, once the novelty has worn off.

Figure 73: Change of Likelihood of recommending to others over time



From responses to: 'How do you think your likeliness to recommend your product to others has changed over the last 6 months, since you completed the first survey?' Q.D1c; n=817

The Net Promoter Score (NPS) is a test of customer satisfaction and loyalty; it is a way of assessing the likelihood that customers will promote a product or brand to their friends and colleagues.[73] It aims to create strong distinctions between products to isolate those most likely to spur very strong word of mouth recommendation. As such, overall results appear more negative than for other measures of satisfaction.

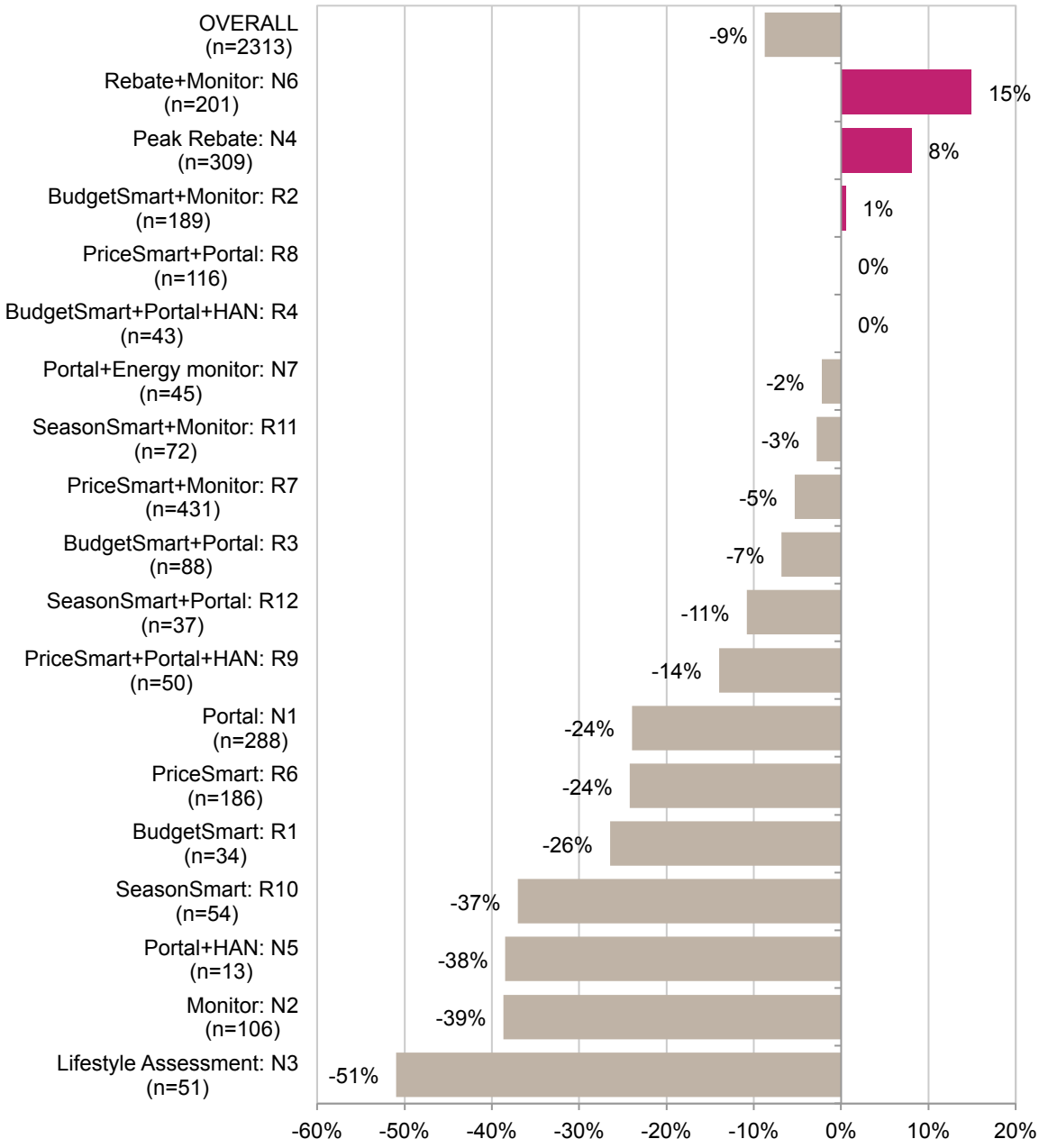
Using respondents' ratings on a scale of 1 to 10, for how likely they would be to recommend a product to their friends or colleagues, they were classified into one of three groups. If the customer reported a likelihood of between 1 and 6 they were considered a 'detractor' and it is assumed that they were unhappy with the product; customers who rated the product as 7 or 8 were considered 'passives' and unenthusiastic about the product; customers who score 9 or 10 were considered 'promoters' of the product or brand. The NPS is derived by subtracting the percentage of detractors from the percentage of promoters.

Three of the 18 products in this research received a positive NPS, while a further two scored 0%. The remainder of products received a negative NPS. The average across all products was -9%.

The Network Peak Rebate with Monitor (N6) received the highest score (15%) followed by the Network Peak Rebate (N4) (8%). The Lifestyle Assessment (–51%) had the worst result, suggesting that respondents would be more likely to criticise than recommend this product.

[73] Net Promoter System, 2013, 'Measuring your Net Promoter score' accessed at http://www.netpromotersystem.com/about/measuring-your-net-promoter-score.aspx

Figure 74: Net Promoter Score



Calculated from responses to: "On a scale of 1–10 where 1 is extremely unlikely and 10 is extremely likely, how likely are you to recommend the product to a friend?" (Q.D1; n=2313)

5

Analysis

This chapter presents a summary of the high-level trends found in the more detailed information presented throughout the body of Chapter 4. It breaks the analysis down by product groups (Section 5.1), vulnerable customer groups (Section 5.2), and also compares customer *perceptions* of their product experiences with *actual* savings (Section 5.3).

5.1 SUMMARY OF PRODUCT ANALYSIS

The summary of the product analysis uses the following key survey questions:

1. Frequency of engagement with the product (Section 4.1.2.2)
2. Customer perceptions of financial savings (Section 4.2.3.1)
3. Impact on customer awareness of energy use (Section 4.2.2.1)
4. Impact on customer ability to reduce energy bills (Section 4.2.2.1)
5. Product satisfaction (Section 4.3.1)
6. Likelihood of recommending product (Section 4.3.4).

Average respondent scores for each of the above questions were used as key indicator metrics to identify differences between the following product groups: the product type (Section 5.1), pricing/incentive type (Section 5.2) and feedback technology type (Section 5.3), as shown in Table 14. Only the findings that were statistically significant are presented in this Section.

Table 14: Categories for broader analysis of products

Broad category	Sub-category	Products Included*	Sample size
Product type	1. Pricing/ incentive only	N4, R1, R6, R10	583
	2. Tech only	N1, N2, N5, N6, N7	747
	3. Combination	N6, R2, R3, R4, R7, R8, R9, R11, R12	1755
Pricing/incentive Structure	Peak Rebate	N4, N6	592
	PriceSmart	R6, R7, R8, R9	1020
	SeasonSmart	R10, R11, R12	499
	BudgetSmart	R1, R2, R3, R4	227
Feedback technology type	Portal only	N1, R3, R8, R12	847
	Monitor only	N2, N6, R2, R7, R11	1447
	Portal+HAN	N5, R4, R9	142

** The products that these numbers refer to are listed in Section 1.2.4. Note that product N3: Lifestyle Assessment is not included in this analysis because of its very different nature compared to all other products. The sample size for this product (n=53) was too small to allow it to be included as its own sub-category. Similarly for product N7: Portal+Monitor the sample size for this product (n=31) was too small to include it as its own sub-category for 'Feedback technology' type and so is excluded from this type of analysis. It is however included in the 'Tech only' grouping in 'Product type'.*

5.1.1 Product type: to incentivise, inform, or both?

The first part of this analysis looks at the differences between how respondents reacted to incentives (or penalties), feedback technologies, and combinations of the two. As discussed in previous sections, individual products were grouped into the following product types:

- Type 1: a pricing or incentive mechanism, e.g. a tariff or rebate (simplified to 'Tariff only' in graphs)

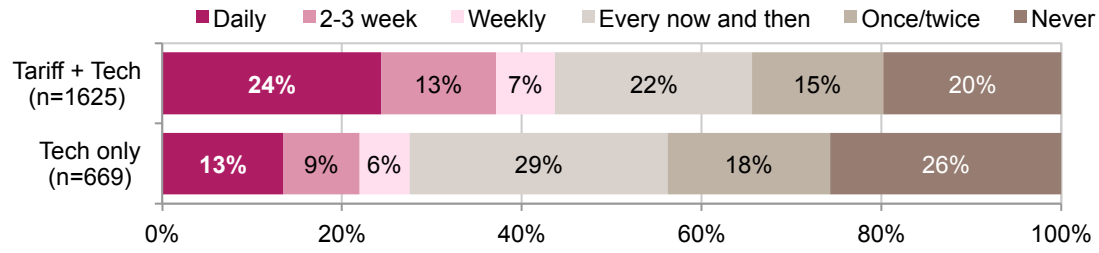
- Type 2: one or more home energy data feedback technologies ('Tech only')
- Type 3: a combination of pricing/incentive and one or more feedback technologies ('Tariff+Tech').

5.1.1.1 Frequency of engagement

By looking at customers' frequency of engagement with the feedback technology, we can compare respondent behaviour with (Type 3) and without (Type 2) a pricing or incentive structure in place. (Note that those respondents who only had a pricing/incentive (Type 1) were not considered in this measure because the question was only asked to those with a feedback technology.)

The data clearly shows that for products that combined both feedback technology and a pricing/incentive structure, the engagement level was higher than for customers who had the technology alone (Figure 75). This difference was statistically significant.[74] This suggests that when customers have a specific financial incentive to be aware of their electricity usage at a particular time of day, feedback technology becomes more useful.

Figure 75: Frequency of engagement, by product type



From responses to: "How often do you use the product that you are trialling?" (Q.C2; n=2294)

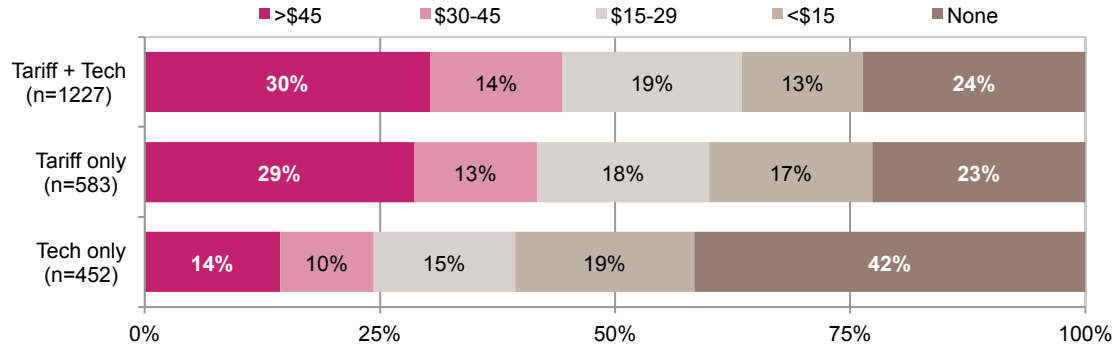
5.1.1.2 Perception of financial savings

Of the three groups, those using a product combining pricing/incentives with technology thought they saved the most amount of money per bill, closely followed by those with purely pricing/incentive products. Technology-only customers' perceptions of savings were substantially lower (Figure 76). These differences were statistically significant.[75] Given the reasonable alignment between actual and perceived savings estimates (refer to Section 5.3.2.1), particularly for those customers who thought their savings were in the lowest or highest categories, it is reasonable to suggest that products involving a tariff or rebate result in higher savings than if customers were only provided with data about their usage.

[74] Kruskal Wallis test, $p<0.001$.

[75] Kruskal Wallis test, $p<0.001$.

Figure 76: Perception of financial savings, by product type



From responses to: "How much money do you think your product saved you off each electricity bill during the trial?" (Q.C14; n=2262)

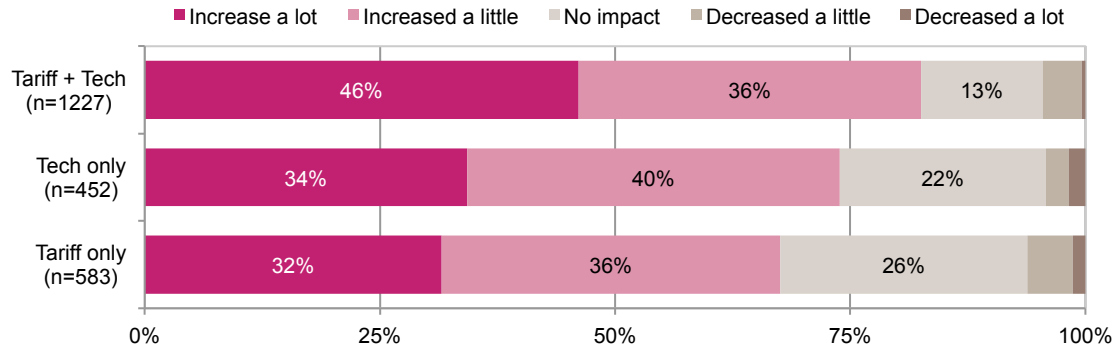
5.1.1.3 Impact on energy awareness and ability to reduce bills

When considering the impact of different products on consumer awareness of their electricity use, a pattern similar to the one described in 5.1.1.2 emerges: Type 3 combination products were clearly associated with greater improvement in energy awareness compared to Type 1 pricing/incentive-only or Type 2 technology-only products (Figure 77). For some consumers it was sufficient to draw attention to their usage through pricing or incentive structures, or by providing a flow of usage information, but the impact was clearly strengthened when these elements were combined.

When considering how this energy awareness empowered consumers to reduce their bills, the findings were very similar to those in Figure 77, with Type 3 combination products showing superior customer outcomes (Figure 78).

These differences between the product types were statistically significant for both energy awareness and ability to reduce bills.[76]

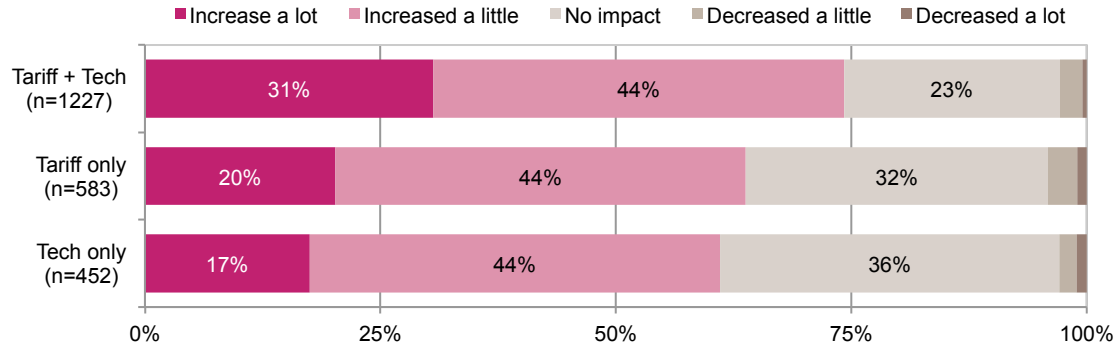
Figure 77: Impact on energy awareness, by product type



From responses to: "Please indicate what effect your product has had one the following: Your awareness of your electricity use…" (Q.C15.1; n=2262)

[76] Kruskal Wallis test, p<0.001.

Figure 78: Impact on ability to reduce bills, by product type



From responses to: "Please indicate what effect your product has had on the following: Your ability to reduce your electricity bills…" (Q.C15.3; n=2262)

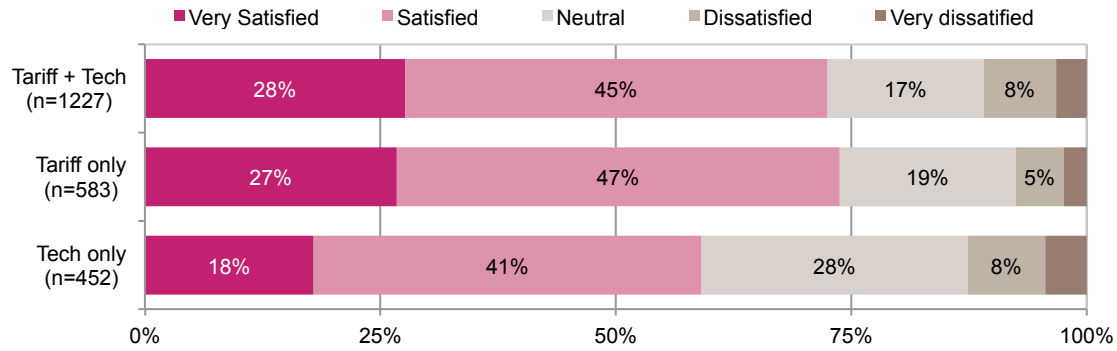
5.1.1.4 Product satisfaction and likelihood of recommending to others

The findings for product satisfaction closely mirror the pattern observed for perceived financial savings, with Type 2 technology-only products recording the lowest levels of product satisfaction, while the results for Type 1 pricing/incentive only and Type 3 combination products were almost the same (Figure 79). While the association between savings and satisfaction was not interrogated statistically, it is reasonable to expect that these factors were linked.

The likelihood of recommending to others (Figure 80) shows a slightly greater distinction between categories, but the same pattern in results.

The differences for satisfaction and for likelihood to recommend were both statistically significant.[77]

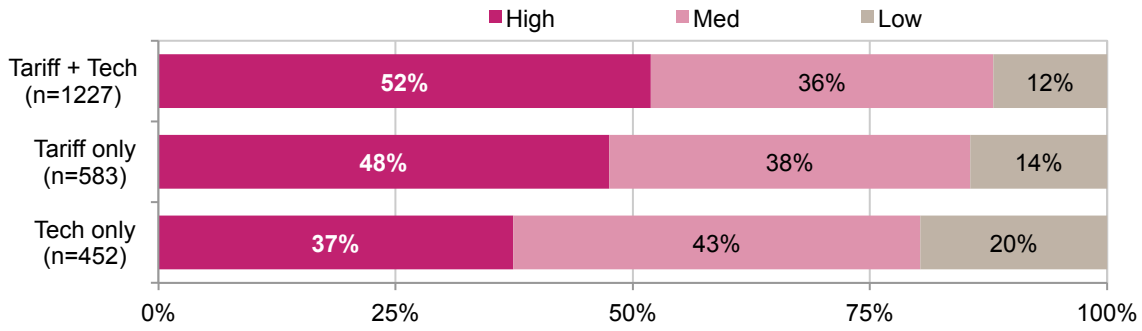
Figure 79: Overall product satisfaction, by product type



From responses to: "Overall, to what extent would you say you are satisfied with the performance of your product?" (Q. C16; n=2262).

[77] Satisfaction: Kruskal Wallis test, p=<0.001, Recommend: Anova test, p<0.001.

Figure 80: Likelihood to recommend, by product type

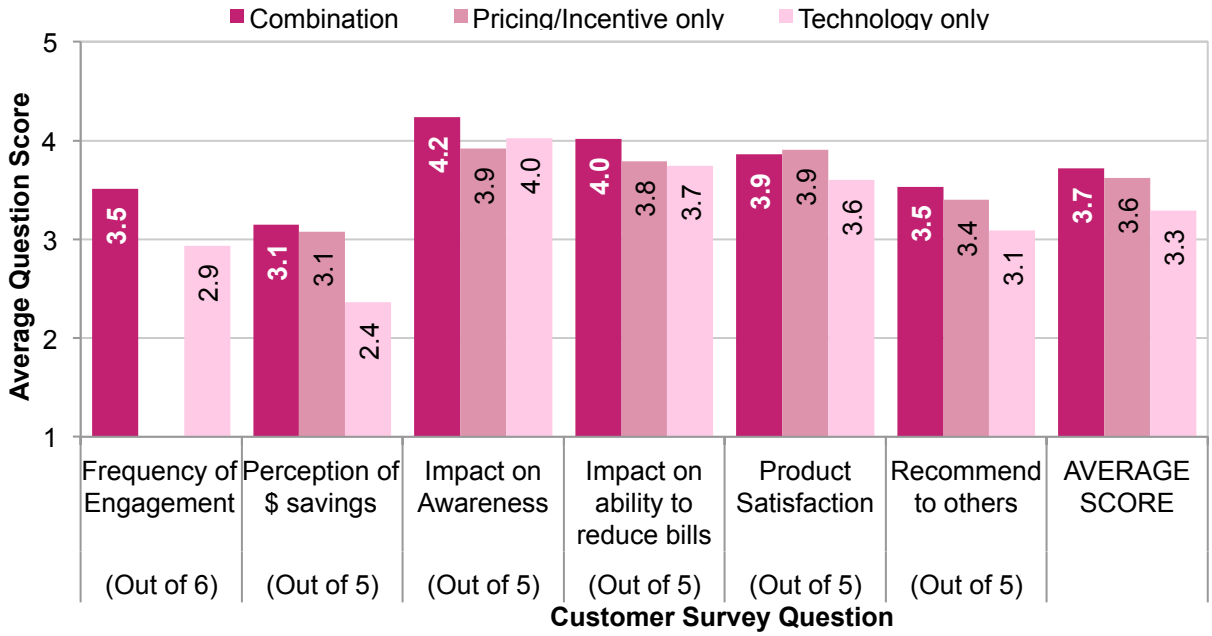


From responses to: "On a scale of 1-10 where 1 is extremely unlikely and 10 is extremely likely, how likely are you to recommend your product to a friend?" (Q.D1; n=2262)

5.1.1.5 Conclusions

The average score for each key indicator was calculated for each product type, and is shown in Figure 81 below. Note that while differences in average scores are small, this represents some real observable differences in the underlying granular data, as shown in the above graphs.

Figure 81: Comparing effect of product types on key customer indicators



Note: Pricing/Incentive only products are excluded from frequency of engagement with feedback technology

The high level of consistency across all of the key indicators was reflected in the average scores, which when totalled (shown on the right of Figure 81) result in a clear 'merit' order of product types for each of the customer indicators. Type 3 combination products were clearly the most favoured by customers in the trial, followed by Type 1 pricing/incentive only customers, and then by those with Type 2 technology only products.

Therefore, while proving customer with information on their use appears to be useful, and offering a tariff or incentive to promote time shifting of electricity use helps to save customers money, providing a customer with both the technology and an incentive optimises customer outcomes across a range of indicators.

It should be noted that these results do not control for the effect of pricing/incentive types on the answers, and as such any conclusions were limited by the extent to which both feedback technology and pricing/incentive type influence the outcome.

5.1.2 Tariff and incentive structures: designing the carrot and the stick

While section 5.1.1 examined the six indicators to determine difference in product type, this section ignores technology only products and examines the same six indicators according to the following tariff and incentive structure products:

- Network Dynamic Peak Rebate
- PriceSmart (Dynamic peak pricing)
- SeasonSmart (Seasonal time of use)
- BudgetSmart (Top up reward plan).

The first product could be considered a 'carrot' as it was structured with a rebate incentive to reduce demand at peak times, while the second two products could be considered 'sticks', as they involve penalising customers by charging higher prices at peak times. BudgetSmart was a prepayment and budgeting plan, increasing user engagement with billing and payments on a regular basis, but does not change their existing tariff structure.

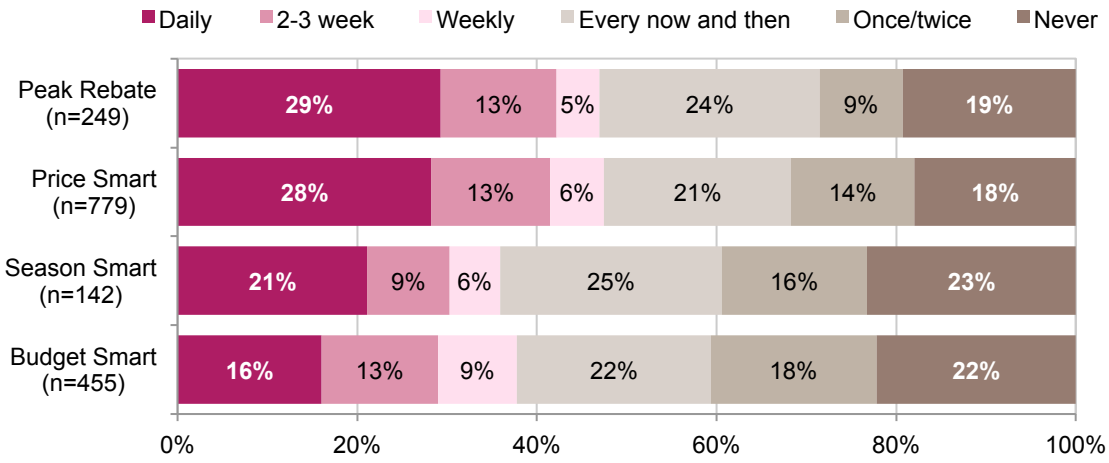
It aims to inform whether there are advantages in providing incentives, penalties or greater customer engagement with billing information.

5.1.2.1 Frequency of engagement

Analysing the frequency of engagement with feedback technology according to the pricing/incentive type reveals interesting results, as shown in Figure 82. Customers with peak event products, both incentive-based (Peak Rebate) and tariff-based (PriceSmart) engaged more frequently with their feedback devices than the customers with the other tariff types did. While customers on SeasonSmart and BudgetSmart were less likely to engage regularly with their device, they still engaged more often than customers with technology only products. These differences were statistically significant.[78]

[78] Kruskal Wallis test, $p<0.001$.

Figure 82: Frequency of engagement, by pricing/incentive type



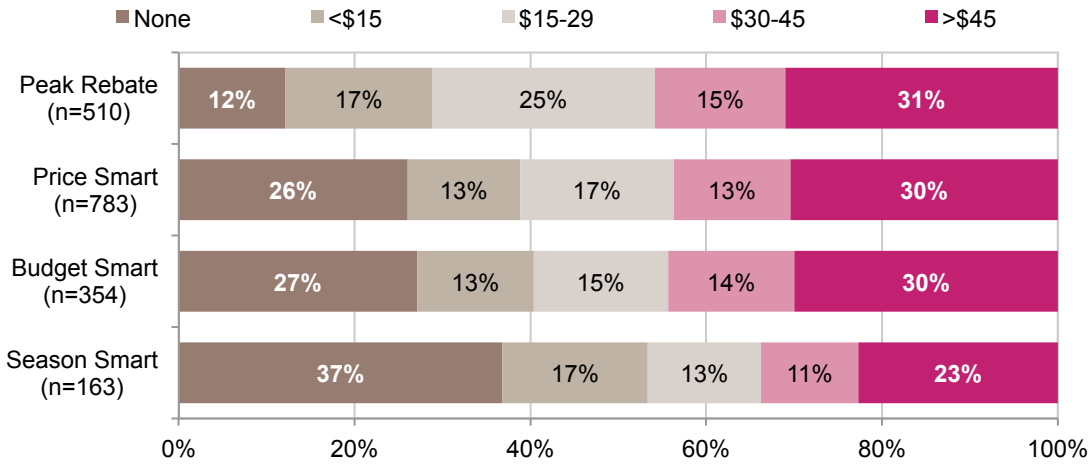
From responses to: "How often do you use the product that you are trialling?" (Q.C2; n=2294)

5.1.2.2 Perception of financial savings

Figure 83 below shows customer perceptions of financial savings according to pricing/incentive type, and reveals a pattern consistent with that observed in frequency of engagement above.[79] However, there was a greater difference between the peak event products, with Peak Rebate customers more commonly reporting larger savings than PriceSmart customers. The analysis of actual savings data in Section 5.3.1.4 suggests that the higher savings reported for the Peak Rebate was largely a matter of perception, as PriceSmart demonstrated higher *actual* savings. A plausible explanation is that as Peak Rebate savings were discrete and put on a credit card for customer use rather than having to be interpreted off a quarterly bill, this leads customers to perceive higher savings. BudgetSmart and SeasonSmart customers report very similar savings, and again these were higher than for technology-only products. These differences were statistically significant.[80]

[79] Note that the graph presents the responses of all customers on the product, including those who chose not to participate in peak events. Those reporting saving "none" *may* include (but does not directly equate to) those who did not participate in events.
[80] Kruskal Wallis test, $p<0.001$.

Figure 83: Perception of financial savings by pricing/incentive type



From responses to: "How much money do you think your product saved you off each electricity bill during the trial?" (Q.C14; n=2313)

5.1.2.3 Impact on awareness of electricity use and ability to reduce bills

The average impact of pricing/incentive type on awareness of electricity use and on ability to reduce bills was relatively small.

For awareness, the differences were statistically significant, but very small. For reducing bills, the differences were small but statistically significant[81] and show the same pattern as for financial savings and frequency of engagement and are thus not shown. Peak event products have the greatest impact, followed by BudgetSmart and SeasonSmart.

5.1.2.4 Product satisfaction and recommend to others

The findings for product satisfaction shown in Figure 84 below also closely mirror the pattern observed throughout this pricing/incentive type series, but for the peak event products, the incentive-based Peak Rebate widens its lead on tariff-based PriceSmart, while BudgetSmart was more clearly favoured over SeasonSmart.

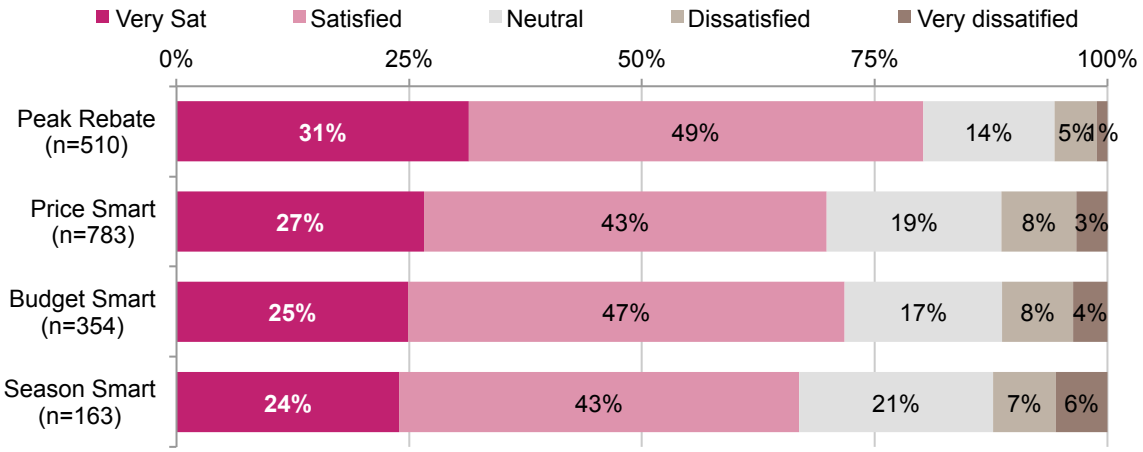
The findings for likelihood to recommend in Figure 85 show the same general pattern, with the Peak Rebate a strong leader. However the tariff-based PriceSmart was outstripped by BudgetSmart tariff (which allows ongoing tracking of billing), and records the same average score as SeasonSmart.

The differences for both metrics were statistically significant.[82]

[81] Kruskal Wallis test, p<0.001.

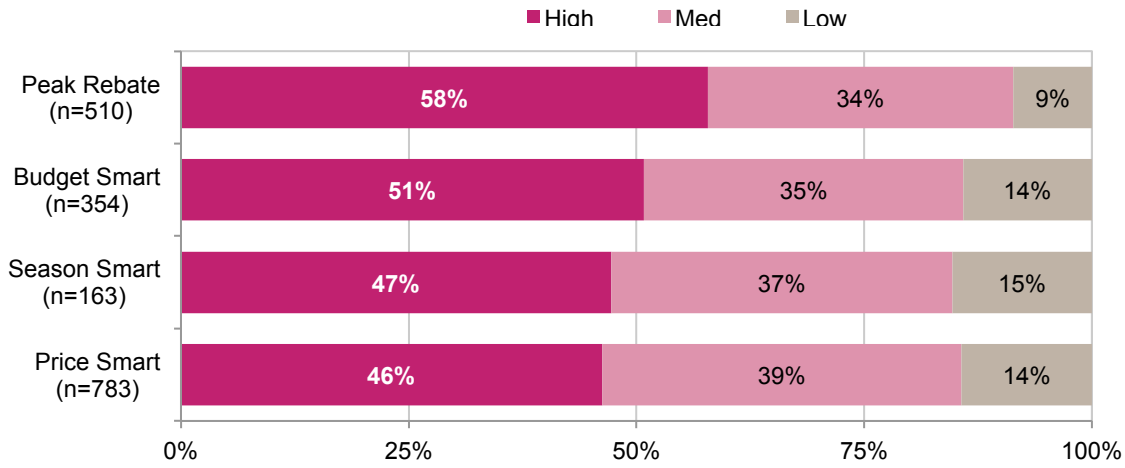
[82] Satisfaction: Kruskal Wallis test, p,0.000, Recommend: Anova test, p<0.001.

Figure 84: Overall product satisfaction, by pricing/incentive type



From responses to: "Overall, to what extent would you say you are satisfied with the performance of your product?" (Q.C16; n=2313)

Figure 85: Likelihood to recommend, by pricing/incentive type



From responses to: "On a scale of 1-10 where 1 is extremely unlikely and 10 is extremely likely, how likely are you to recommend your product to a friend?" (Q.D1; n=2313)

5.1.2.5 Conclusions

The average score for each key indicator was calculated for each product type, and is shown in Figure 86 below. Note that while differences in average scores are small, this represents some real observable differences in the underlying granular data, as shown in the above graphs.

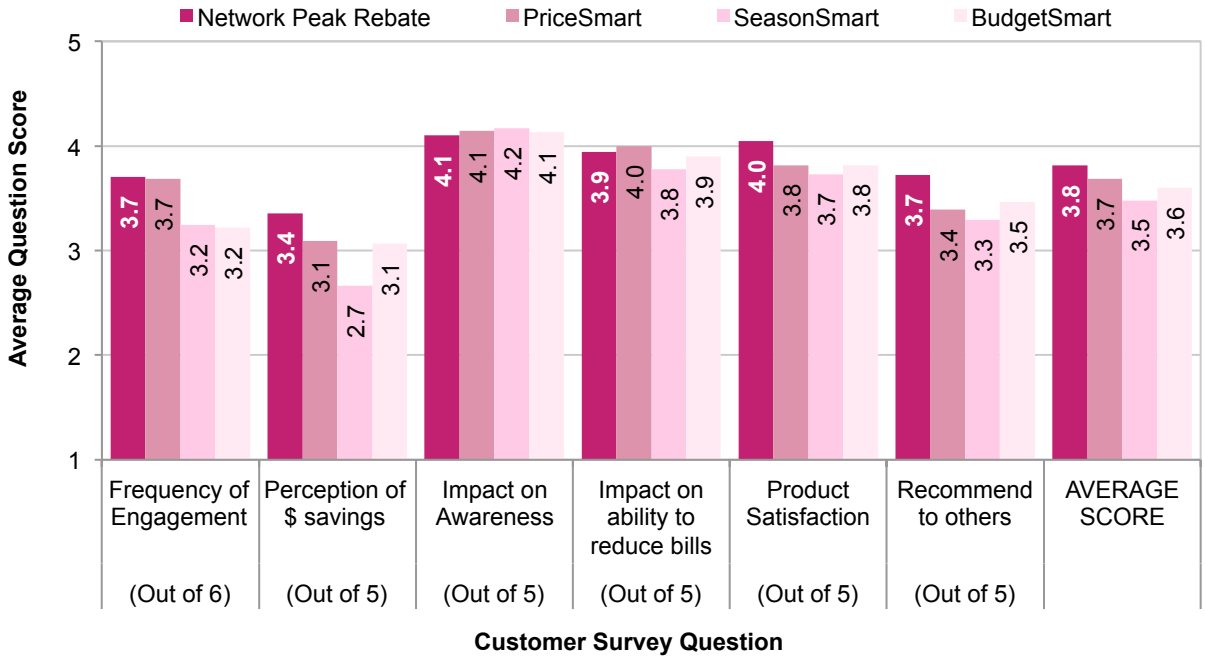
Again, the relatively consistent pattern across all of the key indicators was reflected in the average scores, which when totalled (shown on the right of Figure 86) result in the leader being the incentive-based Peak Rebate. The only category it did not lead was the ability to reduce bills, but as the rebate was provided to a credit card, it is possible that some respondents may have considered this as a separate transaction rather than a bill reduction and this would have lowered its average score for this question.

SeasonSmart was consistently the poorest performer of the pricing/incentive product types, but still showed consistent customer benefits above the technology-only product results.

PriceSmart generally rated almost as well as its peak event counterpart, but less so on satisfaction and likelihood to recommend, although its average scores were reduced to some extent by the very poor performance of the PriceSmart product that did not include a feedback technology (see individual product results in Section 4.2.2.2). Considering the full range of peak event products offered, these results suggest that the 'stick' (higher priced tariff) approach may not resonate as well with customers as the 'carrot' (rebate). And while BudgetSmart was not clearly favoured on most indicators, its satisfaction and likelihood to recommend were unexpectedly high. This may indicate that the unique feature of this product – the more deliberate and constant engagement with actual accrued bill costs – was popular with some customers.

It should be noted that these pricing/incentive type results do not control for the effect of feedback technology types on the answers, and as such any conclusions were limited by the extent to which both technology and pricing/incentive type influence the outcome.

Figure 86: Comparing different pricing and incentive structures on key indicators



5.1.3 Feedback technologies: online or in-home?

While sections 5.1.1 and 5.2.2.2 examined the six indicators to determine difference in product type and pricing/incentive design respectively, this section examines the same six indicators for differences between the following technology types:

1. Online portal ('Portal')
2. Home energy monitor ('Monitor')
3. Home area network (HAN) with appliance control smart plugs, which was also accessed through the online portal ('Portal+HAN').

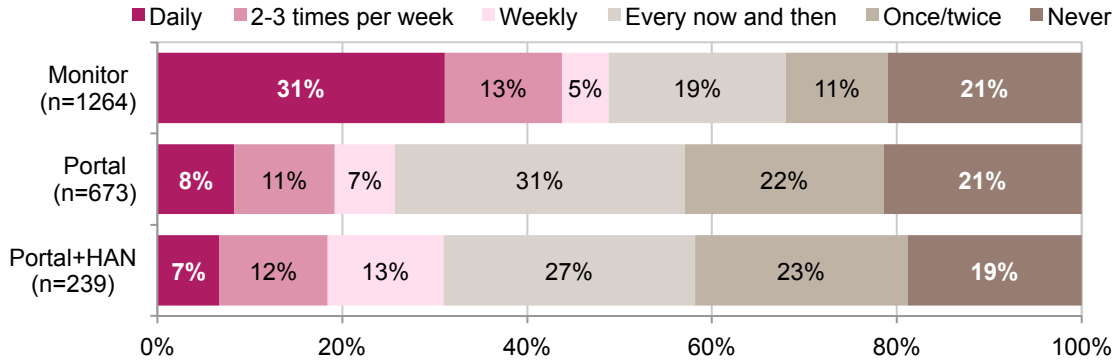
This aims to inform the relative advantages and disadvantages of the three feedback technology types trialled from the customer's perspective.

5.1.3.1 Frequency of engagement

Analysing the frequency of engagement with feedback technology according to the pricing/incentive type reveals interesting results, as shown in Figure 87. The Monitor showed a far higher level of regular user engagement than either Portal product types (Portal only and Portal+HAN), presumably due to the lower entry barriers as a result of being in open sight and not requiring a login.

These differences were statistically significant.[83]

Figure 87: Frequency of engagement, by technology type



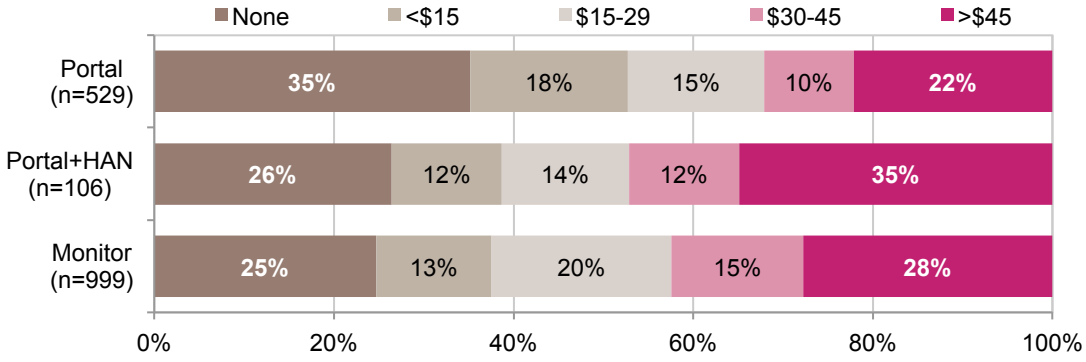
From responses to: "How often do you use the product that you are trialling?" (Q.C2; n=2176)

5.1.3.2 Perception of financial savings

Figure 88 below shows customer perceptions of financial savings according to the technology type, which reveals interesting and different patterns.[84] The Portal showed the lowest level of perceived savings, which may relate to the lower frequency of engagement as shown above. However, the Portal+HAN recorded the highest level of savings by a wide margin, yet this had a similar frequency of engagement to the Portal. Thus it appears that when HAN customers used the portal, the additional features of the HAN (smart plugs allowing appliance monitoring and control) were powerful for unlocking real savings potential for some customers.

The Monitor provided greater perceived savings than the Portal, but less than the Portal+HAN.

Figure 88: Perception of financial savings, by technology type



[83] Kruskal_Wallis test, p<0.001.

[84] These differences were statistically significant. Kruskal_Wallis test, p<0.001.

From responses to: "How much money do you think your product saved you off each electricity bill during the trial?" (Q.C14; n=2268)

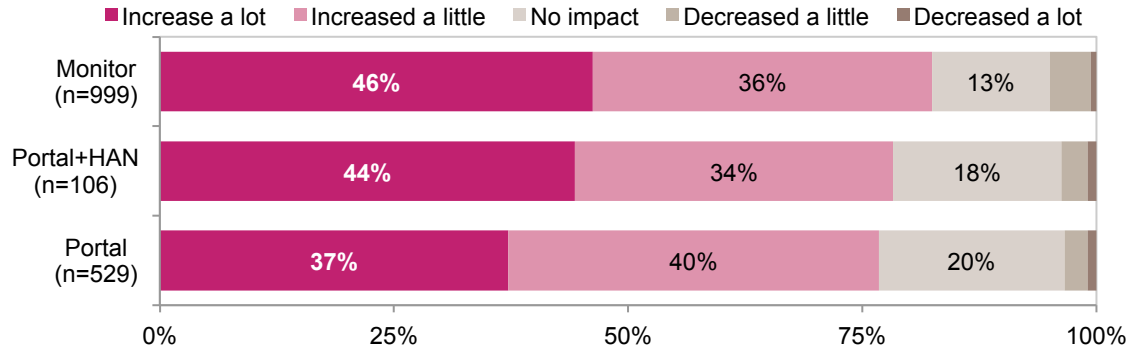
5.1.3.3 Impact on awareness and ability to reduce bills

When considering the impact of technology type on respondents' awareness of their electricity use, we see the monitor performing the best (Figure 89), plausibly driven by its ease of interaction. The Portal+HAN strongly outperforms the Portal alone, presumably as the additional functionality leads to a deeper engagement and understanding. The Portal remains the poorest performer.

Figure 90 shows that the results in fact switch when considering how improved awareness goes on to empower consumers to reduce their bills. The Portal+HAN was the strongest performer for this indicator, so even while many users engaged with the product far less regularly, its value for empowering consumer action to reduce bills was greater. The Monitor still performed well, and the Portal was still the least beneficial from the customer's perspective.

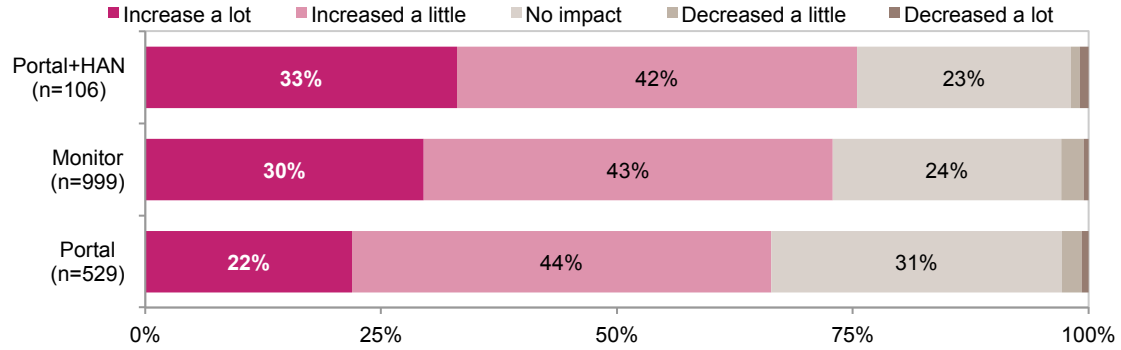
Both results described above were statistically significant.[85]

Figure 89: Impact on awareness, by technology type



From responses to: "Please indicate what effect your product has had on the following: Your awareness of your electricity use…" (Q.C15.1; n=2268)

Figure 90: Impact on ability to reduce bills, by technology type



From responses to: "Please indicate what effect your product has had on the following: Your ability to reduce your electricity bills…" (Q.C15.3; n=2262)

[85] Kruskal Wallis test, p<0.001.

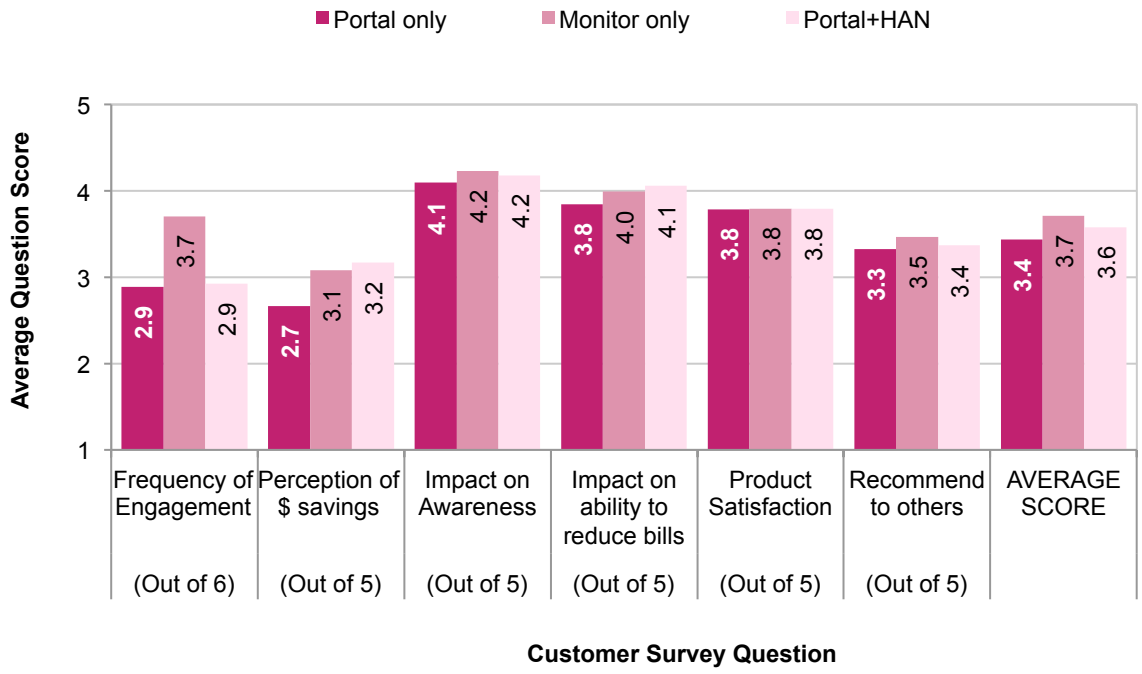
5.1.3.4 Product satisfaction and likelihood of recommending to others

Interestingly, there were no statistically significant differences between the technology types in their impacts on product satisfaction or likelihood to recommend. This was presumably due to the spread of technology types across different tariff products, suggesting that tariff type was a stronger determinant of product satisfaction (and ensuing word of mouth recommendation) than the feedback device used, perhaps as tariff type was more closely linked to bill savings.

5.1.3.5 Conclusions

The average score for each key indicator was calculated for each technology type, and is shown in Figure 91 below. Note that while differences in average scores are small, this represents some real observable differences in the underlying granular data, as shown in the above graphs.

Figure 91: Comparing feedback technologies on key indicators



The high visibility of home energy monitors results in strong customer engagement, which has good flow-on effects in terms of awareness and customer ability to reduce bills. The online Portal was generally much less successful in both regards, as the functionality was similar but the barriers to entry (having to turn on a computer and log in) were higher. However, when combined with the HAN, the additional functionality unlocks strong customer benefits. Despite not achieving a high frequency of engagement, the HAN was most successful in delivering increased ability to reduce bills.

Despite these findings, pricing/incentive type appears to be a stronger determinant of product satisfaction than the feedback device used, perhaps as pricing/incentive type provides greater potential for bill savings.

5.2 VULNERABILITY ANALYSIS

When assessing the impact of new smart grid technologies, services and pricing/incentive structures, it is important to consider the impact on vulnerable customer groups. Vulnerable customers were broken down into several financially vulnerable groups, such as those with low incomes or high sensitivity to electricity bill fluctuations; and household types commonly thought to have less ability to shift their demand outside of peak times such as those with children, the elderly/pensioners, or households that when asked responded that they could not shift any of their load.

5.2.1 Financially vulnerable households

The following trial respondents were categorised as experiencing financial vulnerability:[86]

- households with combined income in the lowest income bracket (≤$41,600 p.a.)
- households that rent with government assistance
- households that occupy public housing.

5.2.1.1 Demographics

Table 15 provides an overview of the some of the characteristics of 'financially vulnerable' households compared to other households in the trial participant group.

Table 15: Significant differences between financially vulnerable and other households[87]

Difference	Description
Housing Type	A lower proportion of financially vulnerable households dwell in a detached residential house compared to others while a higher proportion live in a semi-detached, terrace or townhouse. Very few financially vulnerable households live in units – the same proportion as other households.
Home Ownership Status	All people residing in public housing or renting with government assistance were by definition in the 'Financially Vulnerable' category and therefore these two types form the largest proportion of home ownership types for this group. Of the remaining households in this category (i.e. those in the lowest income bracket), a higher proportion own their home outright compared to others, while a lower proportion have a mortgage compared to others.[88] This high home ownership may be a reflection of the substantial proportion of elderly people in this category who have little direct income but have historical assets.
Income	All people in the lowest income bracket were by definition in the 'Financially Vulnerable' category. Only a very small number of people were in high

[86] We also considered including those who indicated that they had felt unable to pay their energy bill within the last 12 months in this category, however there was a large proportion of people reporting themselves unable to pay who were not in the three groups included in this composite variable. Therefore, as this was a subjective measure it was decided that 'Unable to pay' could indicate lifestyle choices or other circumstances rather than ongoing financial vulnerability. A comparison between 'Financial vulnerable' and 'Unable to pay' showed similar results between the two groups.

[87] Chi-squared test, $p<0.001$ (Dwelling type, Household ownership, Technology type); Kruskal Wallis test, $p<0.001$ (Historical energy consumption, Household income); t-test, $p<0.001$ (household size)

[88] As belonging to certain types of home ownership was a reason for inclusion in the Financial Vulnerable group, comparable percentages cannot easily be calculated for Financially Vulnerable and Other households, so only the general trend has been described.

Difference	Description
	income brackets.
Household size	A substantially higher proportion of financially vulnerable households were smaller, with one-person or two-person households being much more prevalent in the financially vulnerable group. This may point to a limitation of the combined household income measure, which was more likely to include one-person households as only one potential revenue stream was available.
Energy use	The financially vulnerable group contains more low energy users and less high energy users. The proportion of medium energy users was nearly the same between groups.
Technology type	A slightly higher proportion of financially vulnerable households trialling feedback technology have a Monitor only (67%) compared to others (58%). A slightly lower proportion has a Portal only (31% compared to 36% for others) or HAN (2% compared to 7% for others).

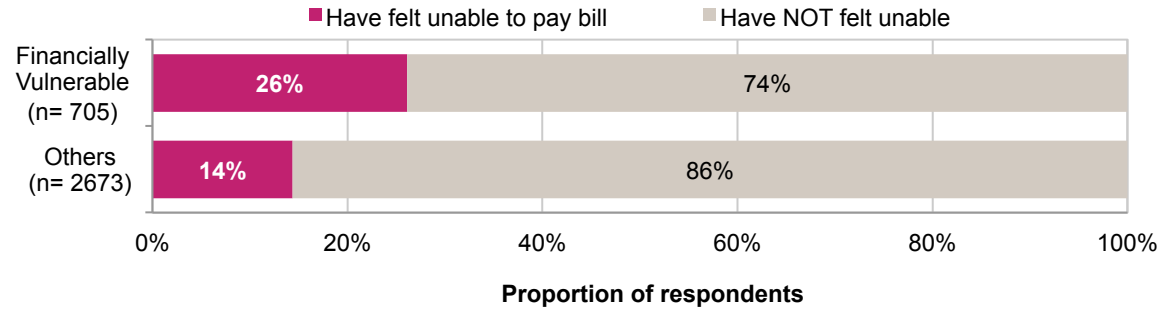
5.2.1.2 Survey responses – key differences

This section discusses a select number of questions or indicators where statistically significant differences exist between financially vulnerable households and other households.

Energy vulnerability

Those in the financially vulnerable group were nearly twice as likely as others to have felt unable to pay their bills within the past year[89] (Figure 92), despite the fact that they were more often low energy users, and were therefore likely to have lower energy bills in aggregate. This suggests that energy bills were likely to make up a higher proportion of expenses relative to income for the lowest income bracket.

Figure 92: Inability to pay energy bills within past year, by financial vulnerability



From responses to: "Have you felt financially unable to pay your energy bills at any stage over the last 12 months?" (Q.B8/2013: CQ.B13; n=3378)

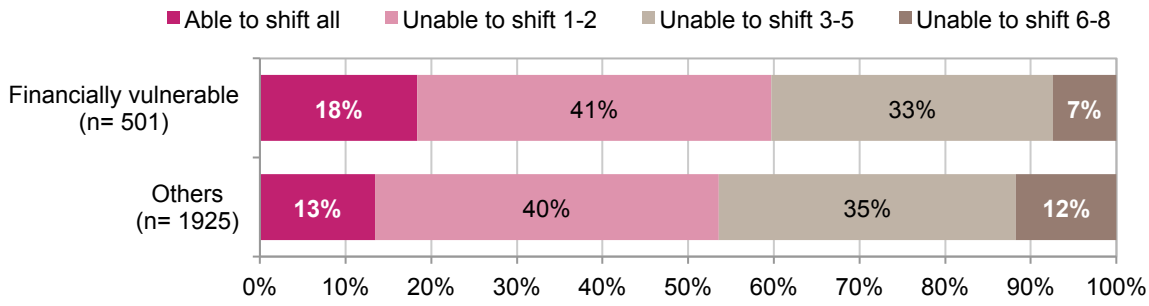
At the same time, financially vulnerable households were more likely than others to think that they can shift the use of a larger number of appliances outside of peak times, with 18% suggesting they could shift all eight listed appliances[90], compared to 13% for other

[89] Fisher test, p<0.001.

[90] Air conditioner, heater, lights, oven/stove, refrigerator, television, shower/bath, clothes dryer

households (Figure 93).[91] The fact that the lower energy using group (with less discretionary energy use) thought they could shift more load suggests that respondents' perceptions of the appliances they could shift was more likely a reflection of their *willingness* rather than their *ability* to shift load. These findings suggest that greater financial vulnerability increased a customer's willingness to shift load, which is an important finding in the context of ensuring that financially vulnerable households are better off in an incentive-based pricing environment.

Figure 93: Ability to shift major appliance use, by financial vulnerability

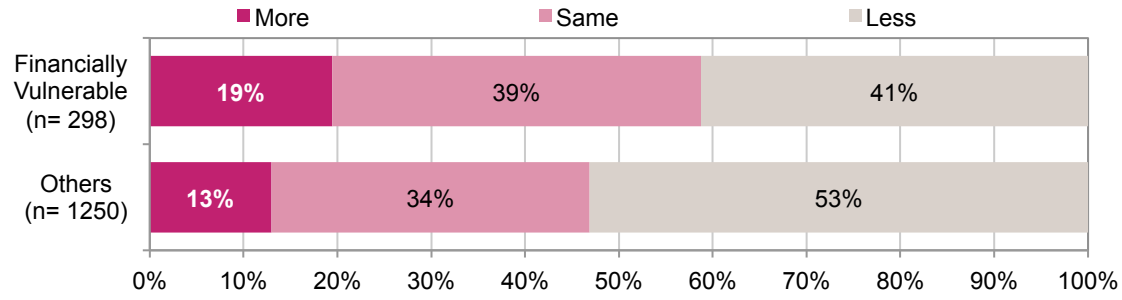


From responses to: "If electricity was more expensive from 2-8pm on week days but cheaper at other times, how much of your usual electricity usage during this period would you be able to shift to other times of day?" (TQ.B9/CQ.B14; n=1952)

Engagement with feedback technologies

When provided with feedback technologies, financially vulnerable households were no different to other households in how often they engaged with the technology, but were less likely to reduce in their use of the technology over time[92] (Figure 94).

Figure 94: Change in use of feedback technology over time, by financial vulnerability



From responses to: "Did you use the product you are trialling more or less over time?" (Q.C2c; n=1548) NB. For respondents with a technology bundle, they were asked this question separately for each technology.

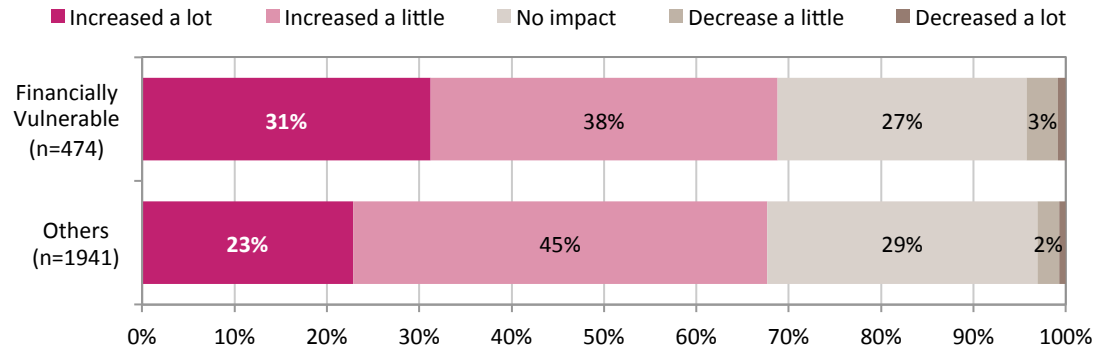
Impact on awareness and control

There were no differences between financially vulnerable and other households, in terms of the impact that using their product had on their awareness of or sense of control over their energy use. However, financially vulnerable households were more likely to report that their ability to reduce their electricity use increased "a lot" as a result of using their product, compared to other households (Figure 95).[93] This is an important finding, and

[91] Fisher Exact test, p=0.005.
[92] Kruskal Wallis test, p<0.001.
[93] Kruskal Wallis test, p=0.027.

supports the earlier suggestion that financially vulnerable households were more willing to make changes to appliance use if there was a benefit to them.

Figure 95: Impact of trial on ability to reduce electricity use, by financial vulnerability

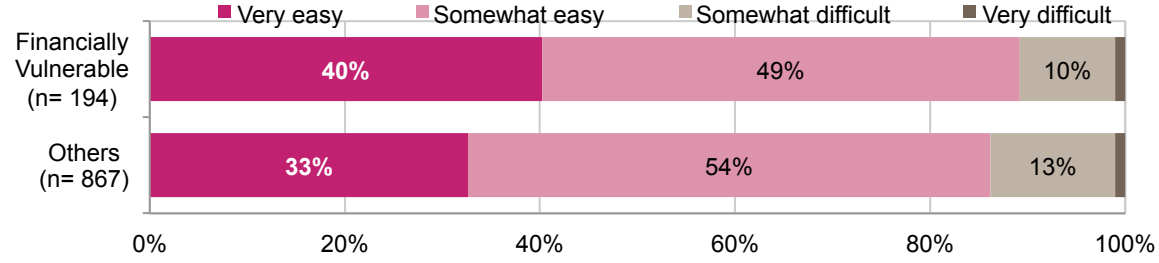


From responses to: "Please indicate what effect your product has had on the following: Your ability to reduce your electricity use…" (Q. C15.3, n=2415)

Behaviour change experiences

Financially vulnerable households were no different to other households in the magnitude of the behaviour change they underwent (see Section 4.2.1), but were more likely to say the changes were "very easy" (Figure 96).[94] This was again perhaps reflective of a greater willingness to make changes where a financial benefit exists.

Figure 96: Ease of making behavioural changes to daily routine, by financial vulnerability



From responses to: "How easy or difficult was it to make these [energy use behaviour] changes to your routine?" (Q.C19b; n=1061).

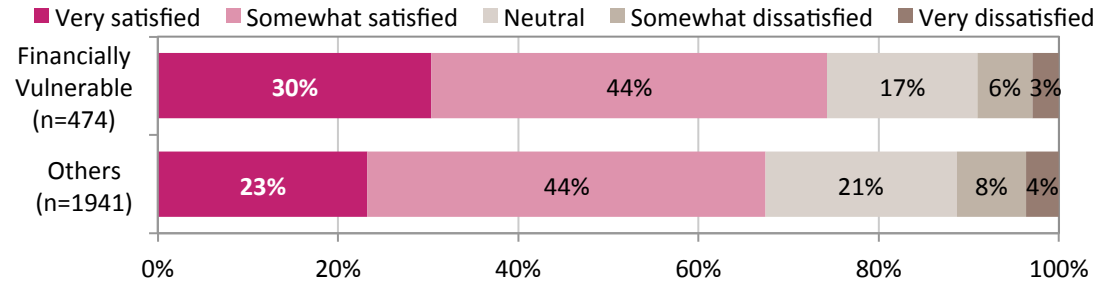
Satisfaction with product

While the above discussion suggests that financially vulnerable households have a greater ability or willingness to shift load, and that they respond well to different smart grid products designed to give greater control, it was important to consider the level of satisfaction they derived from the product during this experience.

Financially vulnerable households were more likely to be "very satisfied" with their product compared to other households.[95] Similarly, financially vulnerable households more often gave a higher rating for their likelihood of recommending their product than other households (54% highly likely to recommend compared to 46% for others Figure 67).[96]

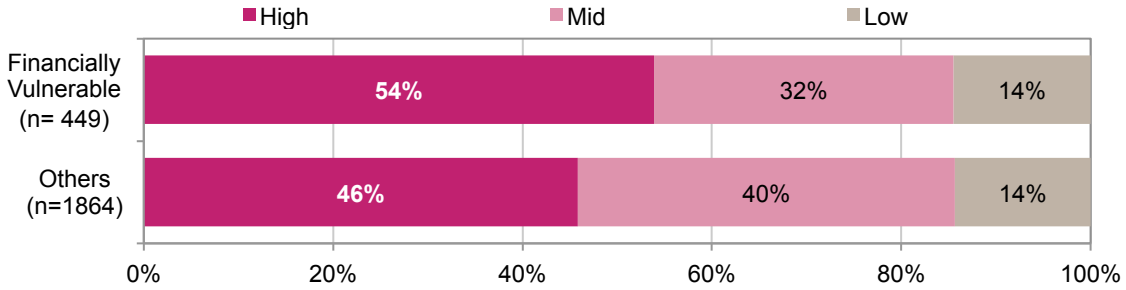
[94] Kruskal Wallis test, p=0.039.
[95] Kruskal Wallis test, p<0.001.
[96] Kruskal Wallis test, p=0.012.

Figure 97: Satisfaction with product, by financial vulnerability



From responses to: "Overall, to what extent would you say you are satisfied with the performance of your product?" (Q.16; n=2415)

Figure 98: Likelihood of recommending product to others, by financial vulnerability



From responses to: "On a scale of 1-10 where 1 is extremely unlikely and 10 is extremely likely, how likely are you to recommend the product to a friend?" (Q.D1; n=2313)

5.2.2 Elderly and pensioner households

Elderly households were considered to be those who had no members under the age of 70, or only one person aged in the bracket 55–69, and the remainder aged 70 or over. This constituted 13% of the trial participant group.

Elderly households, if they fell into the lowest income bracket, were termed 'pensioner' households for the purposes of this analysis.[97] Thus pensioners are a *subset* of elderly households. Pensioner households constituted 47% of the elderly households group (or 6% of the trial participant group).

Pensioner households were of interest as a potentially vulnerable group, as there is often speculation that they may have less flexibility to shift their demand outside of peak times as they have low discretionary energy use and are home in the daytime.

5.2.2.1 Demographics

Table 16 below provides an overview of the statistically significant differences in the demographics of elderly and pensioner household groups compared to all other households.

Table 16: Significant differences between elderly/pensioner and other households[98]

Difference	Description
Language	Almost all elderly households speak English as the primary language at home, compared to a slightly lower proportion for others. This difference was accentuated in pensioner households.
Housing Type	A slightly lower proportion of elderly households dwell in detached residential houses compared to others, while a higher proportion live in units. Very few pensioner households live in semi-detached houses, terrace houses or townhouses, similar to the small proportion for others. These differences were accentuated in pensioner households, who were even more likely to live in units than in detached houses.
Home Ownership Status	A much higher proportion of elderly households own their home outright compared to others, with a much lower proportion having a mortgage or renting privately. A similar number of elderly households live in public housing or rent with government assistance compared to others. Proportions were similar for pensioner households.
Income	A substantially higher proportion of elderly households were in the lowest or second-lowest income bracket compared to other households. Being in the lowest income bracket was a feature of the pensioner group by definition.
Household Size	All elderly households were by definition small, either one-person or two-person households.

[97] Note that the term 'pensioner' is only used as a proxy, and respondents were not asked if they receive an old age pension.

[98] Fisher test, $p<0.001$ (Household language: Elderly & Pensioner); Chi-squared test, $p<0.001$ (Household ownership: Elderly & Pensioner), $p=0.004$ (Dwelling type: Elderly), $p=0.002$ (Dwelling type: pensioner), $p=0.02$ (Technology type: Elderly, Pensioner: Not Sig); Kruskal Wallis test, $p<0.001$ (Historical energy consumption: Elderly & Pensioner, Household income: Elderly & Pensioner); t-test, $p<0.001$ (Household size: Elderly & Pensioner).

Difference	Description
Electricity use	A noticeably higher proportion of elderly households were low electricity users compared to others. A smaller proportion of elderly households have high electricity use. These differences were accentuated in pensioner households. Elderly households have a similar proportion of medium energy household compared with other households.
Technology type	Elderly households have almost the same distribution of feedback technologies as other households, although there were slightly more households with Monitors and very few trialling Home Area Networks (2% compared to 6% for others). This difference was accentuated in pensioner households.

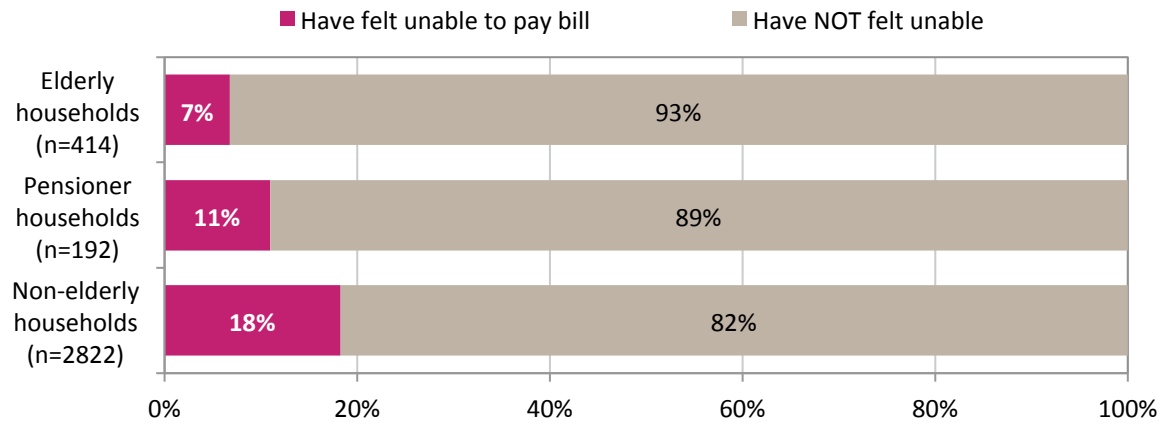
5.2.2.2 Survey responses – key differences

This section discusses a select number of questions or indicators where statistically significant differences exist between elderly and pensioner households and other households.

Energy vulnerability

Elderly households demonstrated somewhat less perceived energy bill vulnerability than others (i.e. they were less likely than others to have felt unable to pay an energy bill within the last year). The difference was ***less*** observable for pensioner households (i.e. pensioner households were closer to general average) but still statistically significant (Figure 99).[99] This is an interesting result given that the financially vulnerable group reported a higher level of bill vulnerability. It therefore seems to be low-income households with younger household members that had a higher incidence of perceived bill vulnerability.

Figure 99: Inability to pay energy bills within past year, by age vulnerability



From responses to: "Have you felt financially unable to pay your energy bills at any stage over the last 12 months?" (Q.B8 (2013CQ.B13); n=3236)

Interestingly, pensioner households were more likely than others (including the broader elderly group) to think that they can shift a larger proportion of their electricity use outside

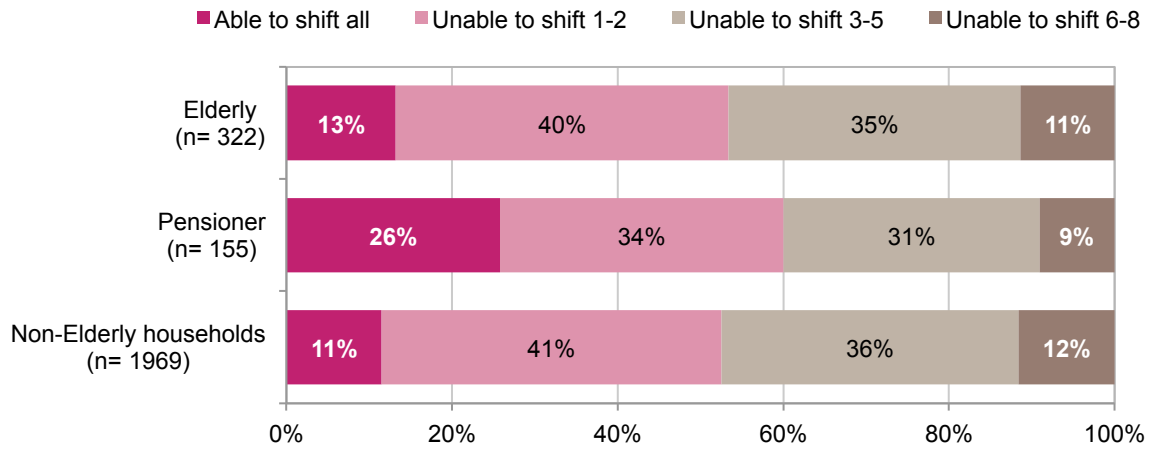
[99] Fisher Exact test, p<0.001 (elderly), p=0.028 (pensioner).

of peak times, with about a quarter suggesting they could shift all eight listed appliances[100], compared to just 11% and 13% for other and elderly households respectively (Figure 100).[101] This result is the converse of popular debate, in which pensioners are often considered less likely to be able to shift load. Although it should be noted that there were still 40% of pensioners who reported being unable to shift three or more appliances, so there was diversity within the pensioner group.

Yet when comparing how often each group they *actually* shifted their time of use during the trial pensioners were not different from other households,[102] while elderly households reported lower incidence of load shifting compared to other households (50% compared to 59%). The difference between elderly and pensioner households in actual shifting, suggests that increasing age decreases the likelihood of the customer shifting use, but the financially vulnerable position of pensioner households counteracts this effect. This same effect was shown in relation to peak event participation further below in Figure 103.

Similar to the discussion in the financially vulnerable households section above (Figure 93), responses to this load-shifting question may largely reflect *willingness* rather than strictly *ability* to shift load, and degree of willingness may be linked to income.

Figure 100: Amount of electricity able to be shifted, by age vulnerability



From responses to: "If electricity was more expensive from 2-8pm on week days but cheaper at other times, how much of your usual electricity usage during this period would you be able to shift to other times of day?" (TQ.B9/CQ.B14; n=1952)

Engagement with feedback technologies

To investigate the impact of age on the ability to interact with new technologies, elderly household data was analysed to determine how easy they found it to set up and use their product. Elderly and pensioner households who trialled a feedback technology as part of their product, less often said it was very easy or easy to both set up and use their feedback technologies compared to other households (Figure 101).[103] Difficulties in setting up technologies were more pronounced in elderly and pensioner households,[104] although the same did not apply to using the technologies once set up.

[100] Air conditioner, heater, lights, oven/stove, refrigerator, television, shower/bath, clothes dryer.

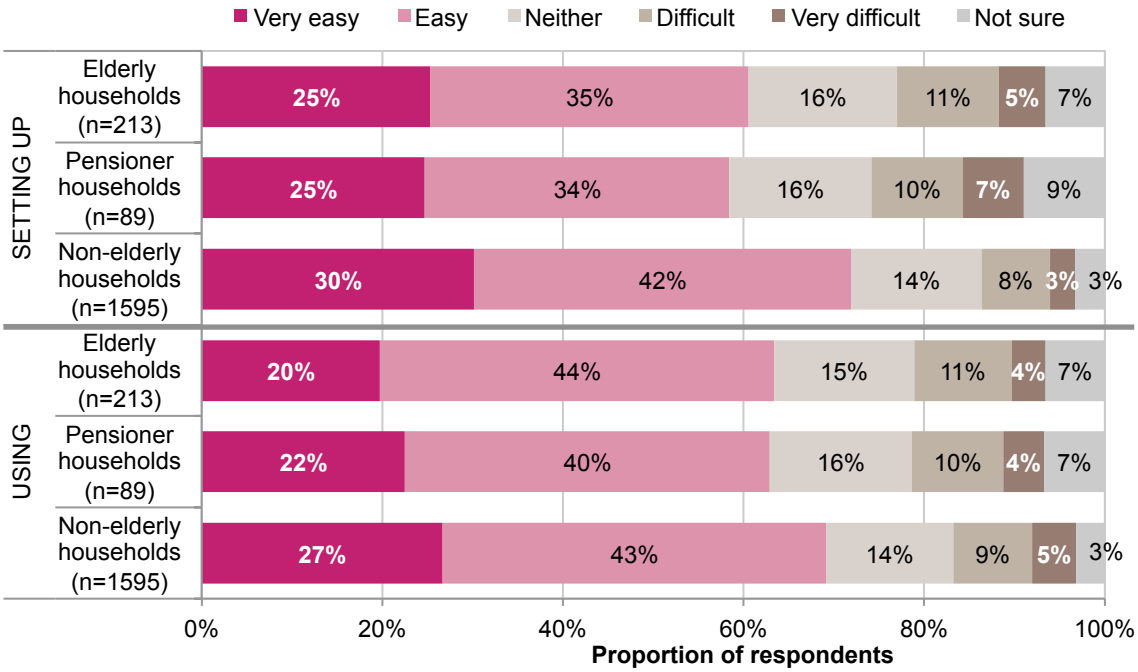
[101] Fisher Exact test, p=0.005.

[102] Fisher Exact test, p=0.014 (elderly). Not sig for pensioner.

[103] Chi-squared test, Ease setting up: p=0.007 (elderly) and p=0.017 (pensioner); Ease using: p=0.05 (elderly), not sig for pensioner.

[104] Those answering difficult or very difficult.

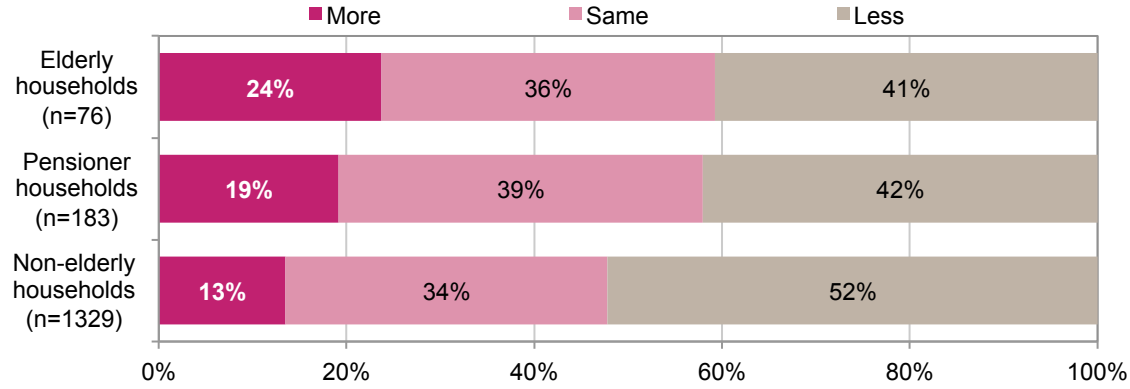
Figure 101: Ease of setup/use of feedback technology, by age vulnerability



From responses to: "How easy were each the following: Setting up your product? Using your product?" (Q.C8; n= 1808) NB. For respondents with a technology bundle, they were asked this question twice: firstly for the Online Portal, and secondly for either the Energy Monitor or control of specific appliances with the HAN through the Portal, and their answers were counted separately.

As with financially vulnerable households above (Figure 94), elderly and pensioner households were no different to other households in how often they engaged with the technology, but they reported increasing or maintaining their level of use of the technology over time more often than other households (Figure 102).[105]

Figure 102: Change in use of feedback technology over time, by age vulnerability



From responses to: "Did you use it more, less or about the same over time? (Q.C2C).

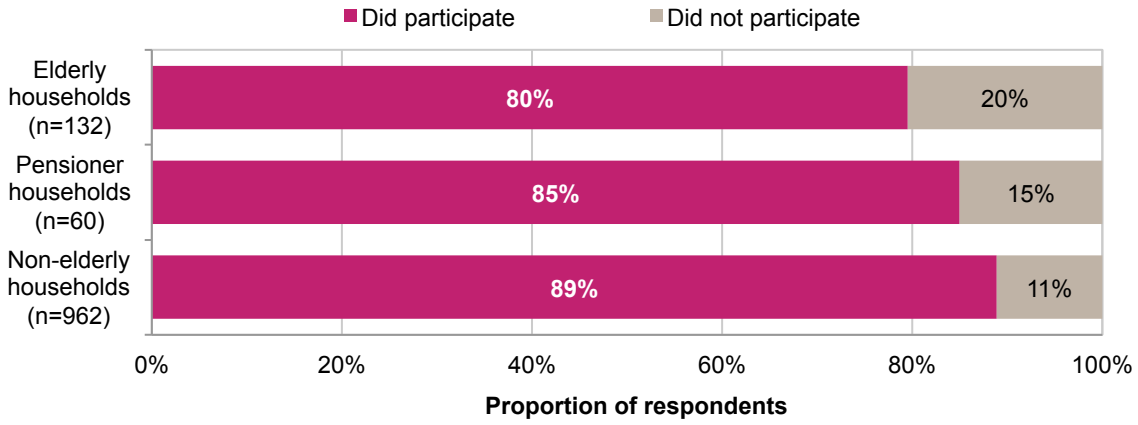
The data indicates that elderly and pensioner households were more likely to prefer the desktop portal to the mobile application than other households, however uncertainties in the collection of this specific question limits the use or application of the data.

[105] Kruskal Wallis test, p=0.005 (elderly), p=0.022 (pensioner).

Peak event experience

As with the general shifting of appliance use, discussed in relation to Figure 100 above, elderly households with peak event products were less likely to report participating in a peak event compared to other households (80% to 89%), though pensioners were closer to the average (85%).[106] This reinforces the idea from above that the older the household, the less likely they were to engage strongly with the product and obtain the benefits, but having a lower income offsets some of this 'age effect', bringing responses back towards the average.

Figure 103: Self-reported participation in peak events, by age vulnerability



From responses to: For Network respondents, "As a result of a peak event did you receive any rebates (to the credit card provided for the trial)?" For Retail respondents, "Did you reduce your electricity consumption during the peak pricing event?" (Q.C5d; n=1154).

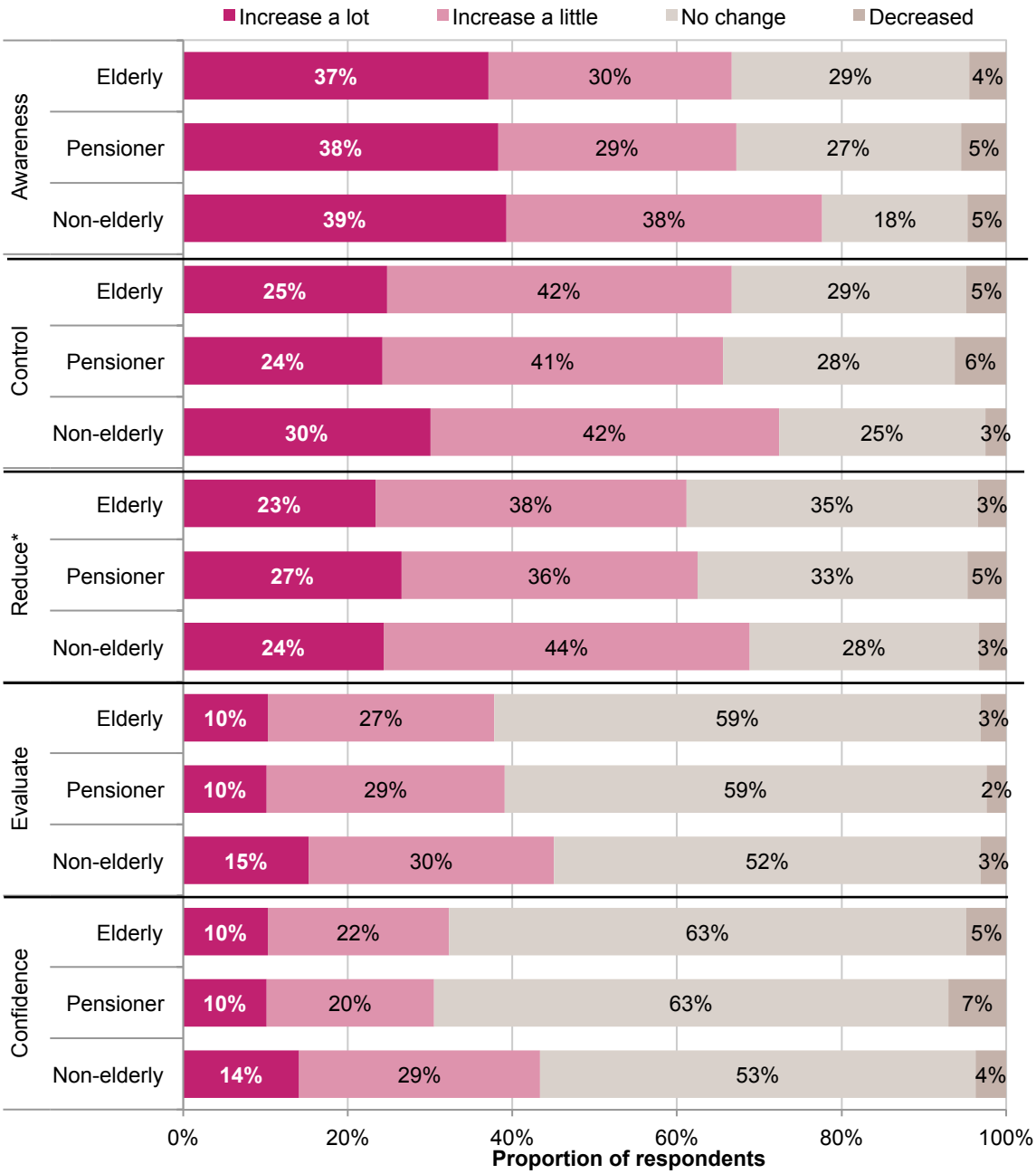
Energy awareness, control and literacy

There was a general trend of less elderly and pensioner households reporting that their use of their product had increased the various elements of energy awareness, control and literacy (Figure 104).[107] This may be linked to the lower participation in load shifting and peak events discussed above.

[106] Fisher test, p=0.007(elderly). Difference not significant for pensioner.

[107] Kruskal wallis test, p=0.022 (Elderly: Awareness), p=0.014 (Elderly: Control), p=0.013 (Elderly: Evaluate), p=0.001 (Elderly: Participate). Elderly: Reduce was just outside the significance level.

Figure 104: Impact of product use on energy awareness, control and literacy, by age vulnerability



** No statistically significant difference between elderly and non-elderly households for 'Ability to reduce bills' . Elderly n=291, Pensioner n=128, Non-elderly n=2045*

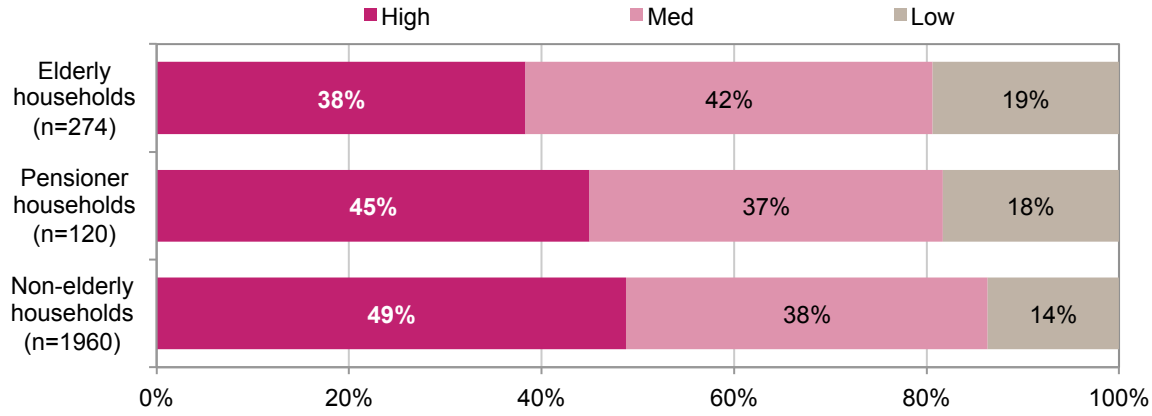
From responses to: 'Please indicate what effect your product has had on the following: Your awareness of your electricity use; Your control over your electricity use; Your ability to reduce your electricity bills; Your ability to budget your electricity use' (Q. C15, n=2415)

Satisfaction with product

There were no observable differences in the level of overall satisfaction with their product between elderly households and other households. However, elderly and pensioner households more often rated their likelihood of recommending their product as lower than other households. This difference was less pronounced for pensioner households (Figure

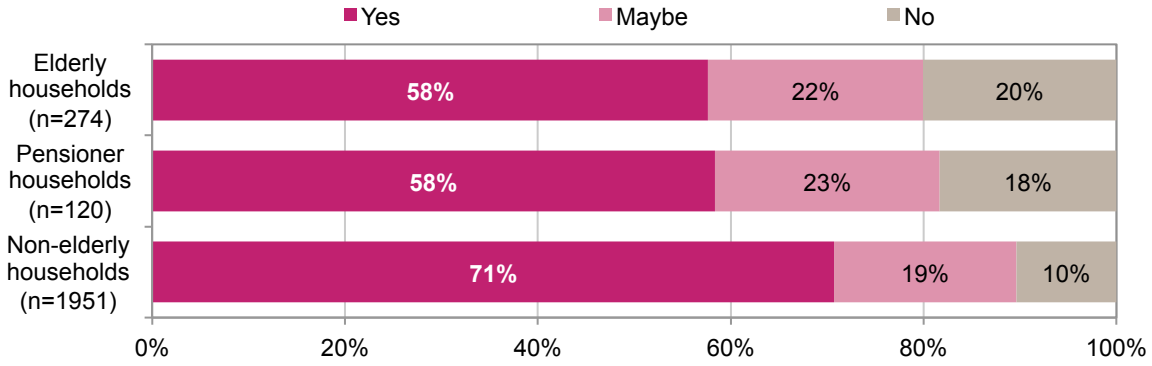
67). [108] This same trend was seen in the reduced desire of elderly and pensioner households to continue to use their product (Figure 106). [109]

Figure 105: Likelihood of recommending to others, by age vulnerability



From responses to: "On a scale of 1-10 where 1 is extremely unlikely and 10 is extremely likely, how likely are you to recommend the product to a friend?" (Q.D1; n=2354), NB: ratings have been collapsed to low (1–3), med (4-7), high (8-10).

Figure 106: Desire to continue to use product, by age vulnerability



From responses to: "The following question does not commit you to anything, and is just to help us gauge if your product was useful. If your product was available as an option from your energy provider would you be interested in using this product again?" (Q.D2; n= 2345)

[108] Kruskal Walles test, p<0.001. No significant difference for pensioner.

[109] Fisher Exact test, p<0.001 (elderly), p=0.024 (pensioner).

5.2.3 Households with Children

To test the hypothesis that households with children have a more limited ability to shift load than other households, this section analyses this subset of the trial participant respondent group.

Children (people under the age of 18) were classified in this analysis as either "young children", or "older children". Table 17 shows the proportion of households with children of different ages.

Table 17: Proportion of households with children

	Proportion of trial group households
No children	66%
Children (of any age)	34%
Young children	*5%*
Young & older children	*8%*
Older children	*21%*

5.2.3.1 Demographics

Table 18 below provides an overview of the demographics of households with children with compared to other households. Note that the categories shown in the table are not mutually exclusive. That is, households can have both young and older children, meaning they represent a combination of the two groups.

Table 18: Differences of households with children compared to households without[110]

Demographic	Differences
Language spoken at home	Households with young children were more likely to **not** have English as a primary language compared to households without children and households with only older children. This may represent more recent increase in ethnic diversity in the trial region.
Dwelling type	Households with older children were more likely to dwell in a detached residential house compared to households without children and households with only young children. The reverse was true for units. Proportions living in in semi-detached, terraces or townhouses similar across all households.
Household ownership	A much smaller proportion of households with children own their own home compared to households without children, while a larger proportion own with a mortgage. Proportions for other ownership types for households with children were similar to other households.
Household size	Households with children have a higher average number of occupants compared to households without children.
Household income	A higher proportion of households with children fall into the highest two income brackets, i.e. more than $100,000 compared to households with no children, and

[110] Fisher test, p=0.018 (Household language); Chi-squared test, p<0.001 (Dwelling type, Household ownership); Kruskal Wallis test, p<0.001 (Historical energy consumption, Household income); t-test, p<0.001 (Household size).

Demographic	Differences
	less often fall into the lowest income bracket.
Energy usage	Households with only young children have similar levels of pre-trial energy consumption as households with no children. Households with older children were more likely to have high energy consumption compared to households with no children, and less likely to have low energy consumption.
Technology type	There were no statistically significant differences in technology type between households with and without children.

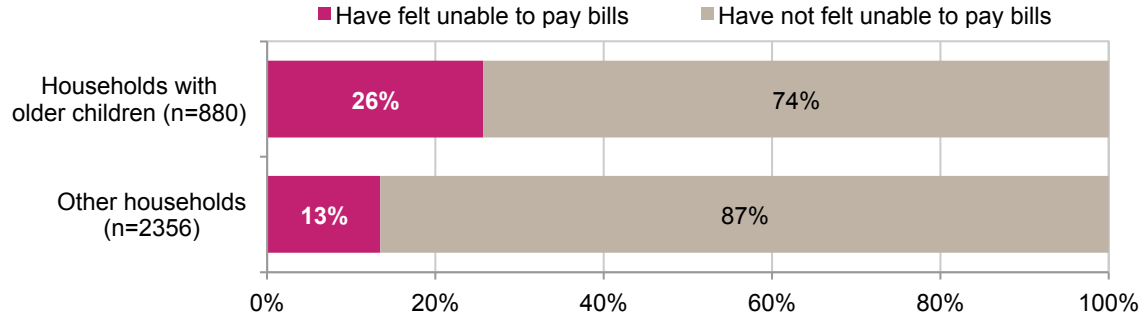
5.2.3.2 Survey responses – key differences

For some questions, the presence of any children, irrespective of age, appears to have made a difference to a household's experience in the trial, while in other cases only the presence of either younger or older children appears to have an effect. The following analysis presents the most relevant breakdown of children/no children for each element discussed.

Energy vulnerability

A substantially higher proportion of households with older children report feeling unable to pay their electricity bill within the past year (26%) compared to households with no children or young children only (13%) (Figure 107).[111] This was the same result as the one for the financially vulnerable group (see Figure 92), suggesting that despite higher incomes, the larger family size and higher energy use of this group results in a similar level of bill pressure.

Figure 107: Inability to pay energy bills within past year, by presence of children

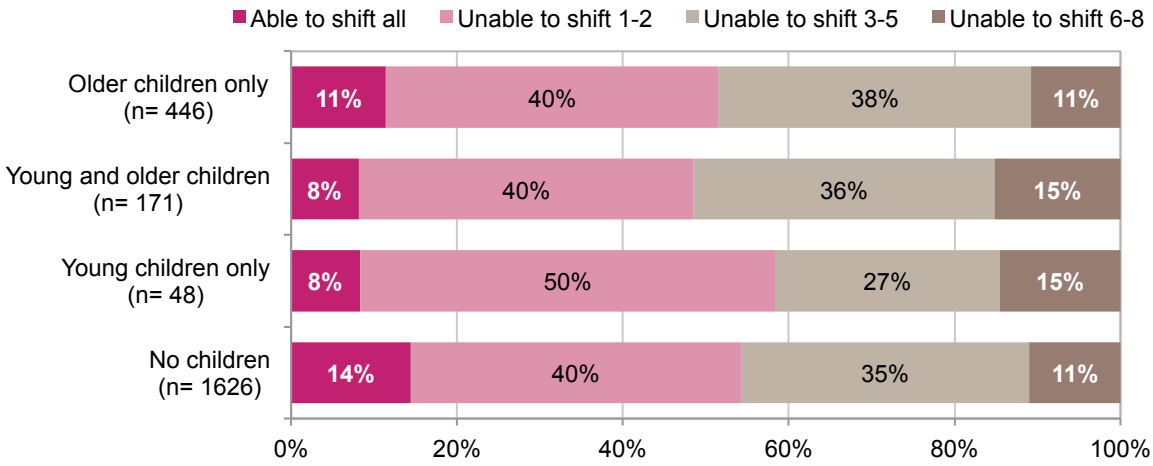


From responses to: "Have you felt financially unable to pay your energy bills at any stage over the last 12 months?" (Q.B8 (2013: CQ.B13); n=3236)

Households with children, particularly younger children, identify their opportunities for shifting electricity use from peak times to be slightly lower than other households (Figure 108). This indicates a potential vulnerability of this group to time based pricing.

[111] Chi-squared test, $p<0.001$.

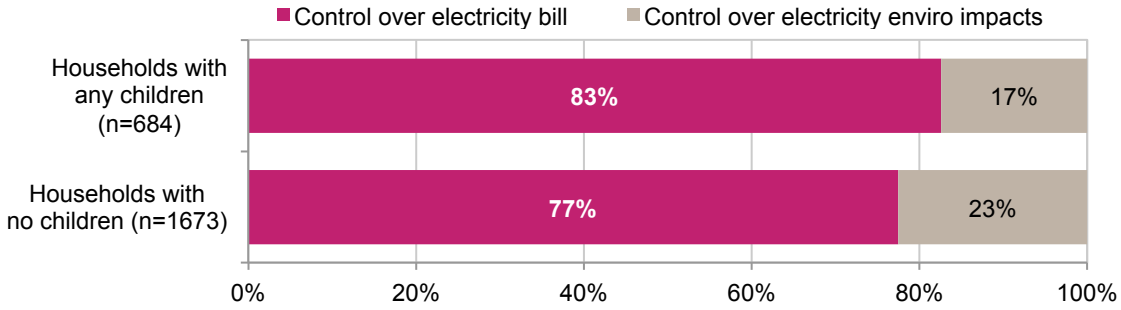
Figure 108: Amount of electricity able to be shifted, by presence of children



Desire for control over electricity bills

A higher proportion of households with children felt strongly about wanting control of their bill than households with no children (Figure 109).[112] This was likely to be linked to energy bill vulnerability discussed above.

Figure 109: Perspective on control of bill as a priority, by presence of children



From responses to: "To what extent do you agree with the following statements: I want more control over the cost of my electricity bill". (Q.B7.1, n=1952)

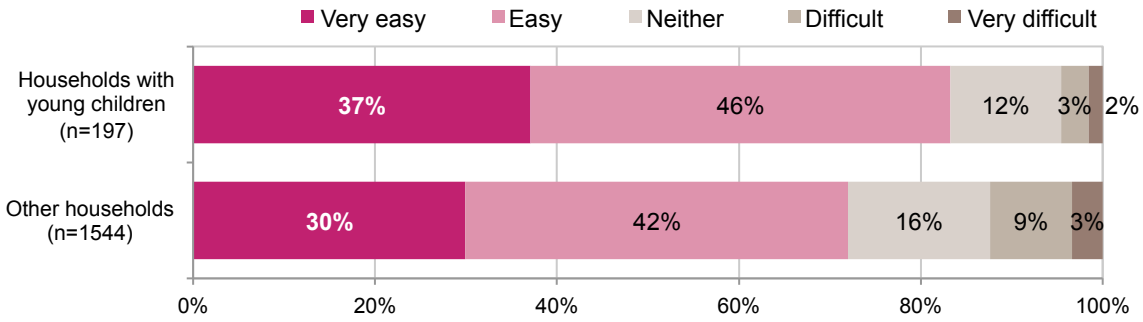
Engagement with feedback technologies

Households with young children more often reported finding it easy or very easy to set up their home feedback technology (83%) compared to households with no children or only older children (72%) (Figure 110).[113] This was not related to the type of feedback technology as they have the same spread as other households (see Table 18 above), but could reflect the probable younger age of parents in this group.

[112] Chi-squared test, p=0.037.

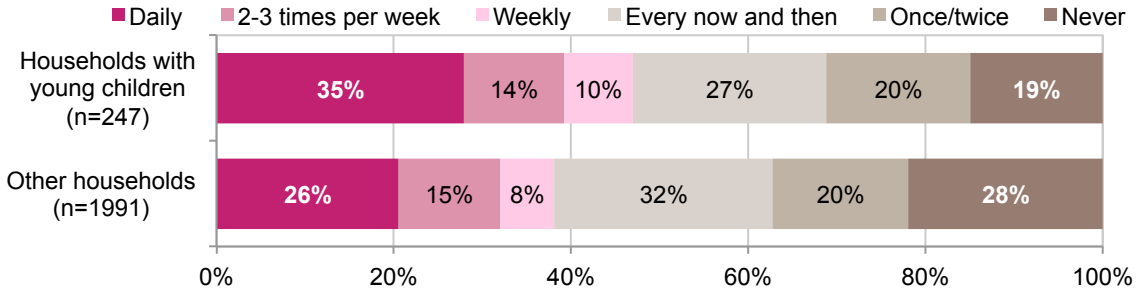
[113] Chi squared test, p=0.044.

Figure 110: Ease of setup of feedback technology, by presence of children



When examining how these households use feedback technologies, it was found that those with younger children checked their feedback device more often than other households (Figure 111).[114]

Figure 111: Frequency of usage of feedback technology, by presence of children



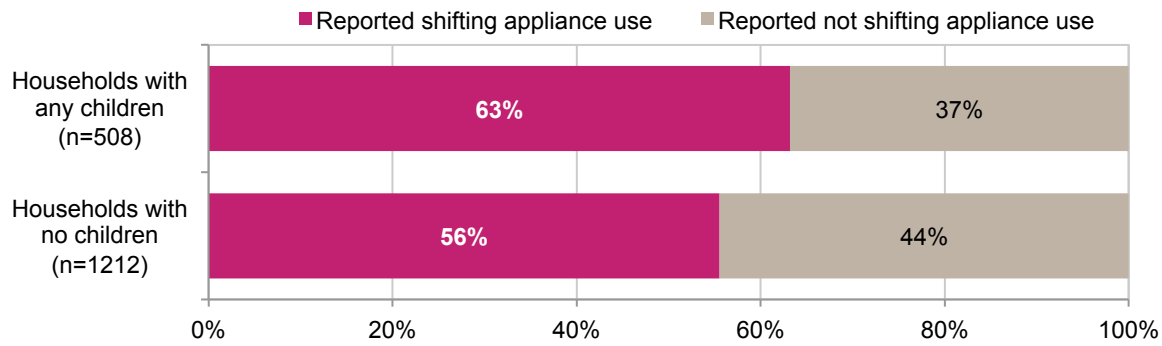
Behaviour Change

So while those with children tended to engage well with the technologies, driven by a desire for increased control of bills (and potentially a younger, more technology savvy age group), this did not clearly result in positive behaviour change outcomes. No significant difference was found in household self-reported reductions in energy usage during the trial for those with and without children. Households with children more often reported shifting their time of energy use in the trial (Figure 112), but this did not translate to higher than average participation in peak events.

While perceived financial savings were slightly higher for those with children than those without, no clear pattern emerged according to the age of children. It was thus difficult to draw clear conclusions on these metrics.

[114] Kruskal Wallis test, p=0.022.

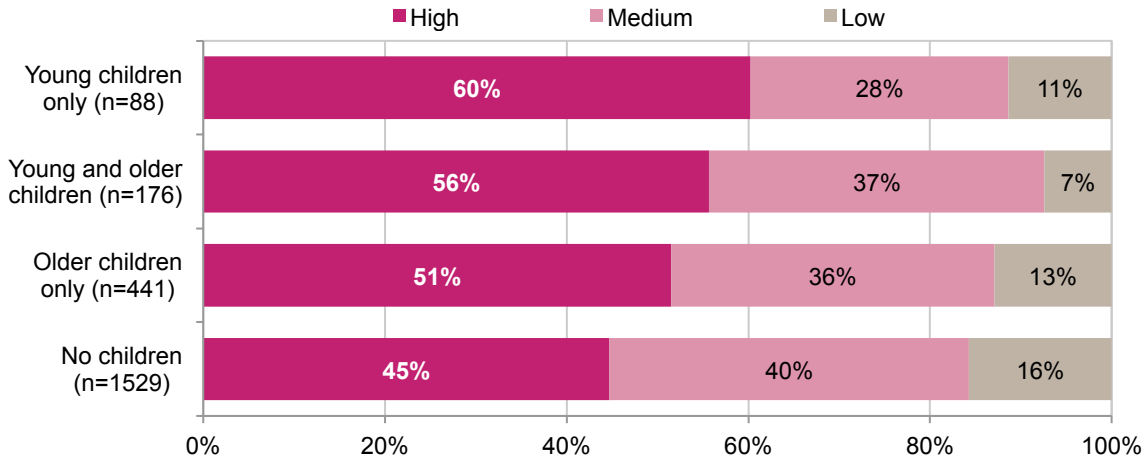
Figure 112: Self-reported change in time of day of electricity use, by presence of children



Product conclusions

While slightly higher product satisfaction was observed for households with children, this was not found to be statistically significant. However, households with children, particularly households with young children, had a higher likelihood of recommending their product to others, (Figure 113).[115] A similar pattern was observed in the data showing a desire to continue to use the products (Figure 114),[116] however in this instance those households with young *and* old children show the highest desire to continue to use. This may relate to a larger number of children in the house (given the broader age range applied), but this has not been tested.

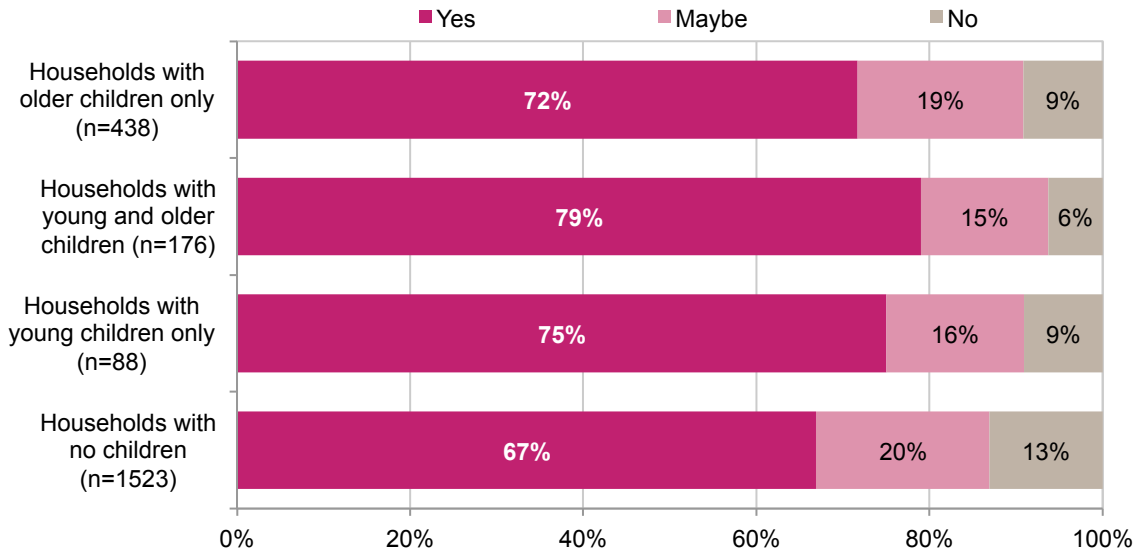
Figure 113: Likelihood to recommend, by presence of children



From responses to: "On a scale of 1-10 where 1 is extremely unlikely and 10 is extremely likely, how likely are you to recommend the product to a friend?" (Q.D1; n=2354), NB: ratings have been collapsed to low (1–3), med (4-7), high (8-10).

[115] Chi squared test, p<0.001
[116] Chi squared test, p<0.001

Figure 114: Interest in continuing to use product, by presence of children



From responses to: "The following question does not commit you to anything, and is just to help us gauge if your product was useful. If your product was available as an option from your energy provider would you be interested in using this product again?" (Q.D2; n=2225) NB. Respondents with Product N3 Lifestyle Assessment were not asked this question.

These results do not show the same level of consistency as the results in the financially vulnerable and elderly/pensioner analysis, however the results suggest that households with children were responsive to the trialled products, particularly in terms of interaction with feedback technology, and in terms of responding to load shifting opportunities. This experience was sufficiently positive for a higher than average desire to continue use of the products on a longer term basis.

5.2.4 Top electricity users

Data for the top 10% and top 20% of electricity users[117] within the survey was obtained to investigate features that define this group of customers and to see if it was possible to isolate certain products, product types or factors that shed light on how to tap energy and peak savings within this very high electricity using group.

5.2.4.1 Demographics

Table 19: Significant differences between top energy using households and others[118]

Difference	Description
Language spoken at home	Households with top 20% energy usage were even more likely to have English as a primary language compared to other households.
Dwelling type	Households with top 20% energy usage were even more likely to dwell in a detached house compared to other households, and this was more pronounced for those in the top 10%.
Household ownership	Households with top 20% energy usage had higher levels of home ownership (either outright or with a mortgage) compared to other households, and lower levels of all other ownership types.
Household size	Households with top 20% energy usage have a higher average number of occupants compared to other households, and this was more pronounced for those in the top 10%.
Household income	Households with top 20% energy usage were much more often in the two highest income brackets, i.e. income >$100,000 and much less often in the lowest income bracket, i.e. <$46,000 compared to other households. Proportions across the middle three income brackets were roughly similar.
Technology type	Households with top 20% energy usage had a slightly lower incidence of trialling the Monitor (52%) compared to other households (62%), and slightly higher incidence of trialling the Portal (40%) and Portal+HAN (7%) compared other households (34% and 4% respectively).

5.2.4.2 Survey responses

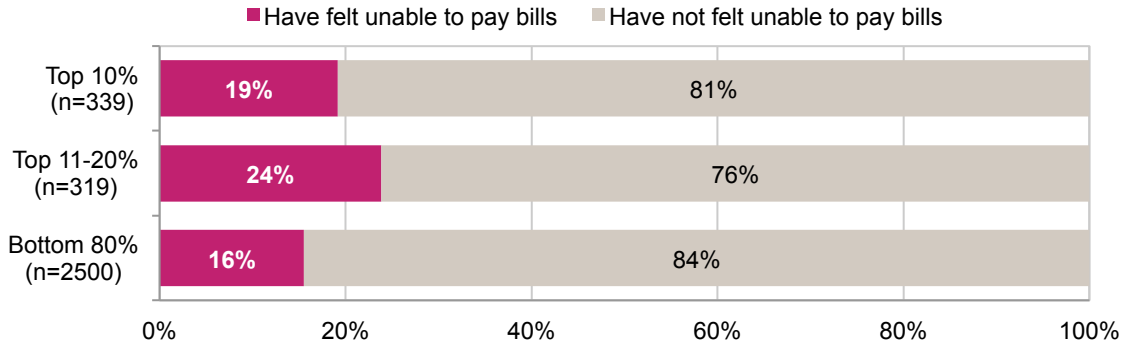
Energy vulnerability

Top energy users were more likely to have felt financial stress in the previous 12 months (Figure 115), despite having a much larger proportion in the highest income bracket. Interestingly, the number of users who reported having experienced financial stress was higher for the second-top 10% (the 11–20th percentile group) than the actual top 10%. This suggests that those in the top 10% may have higher incomes and hence lower energy bill vulnerability.

[117] Note that 217 respondents were not in the customer energy usage data, and so were excluded from this analysis.

[118] Chi-squared test, p<0.001 (Household language, Dwelling type, Household ownership), p=0.004 (Technology type); Kruskal Wallis test, p<0.001 (Historical energy consumption, Household income)

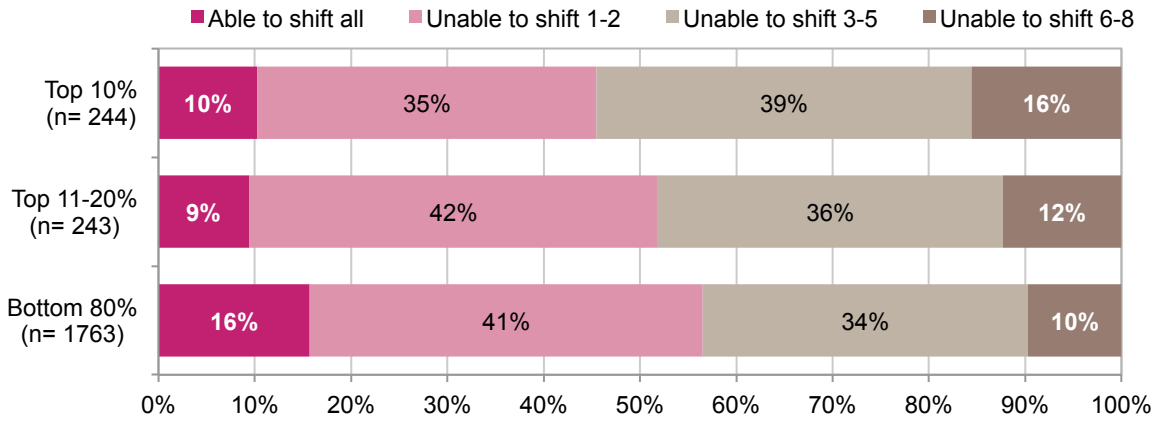
Figure 115: Inability to pay energy bills within past year, by level of energy usage



From responses to: "Have you felt financially unable to pay your energy bills at any stage over the last 12 months?" (Q.B8 (2013: CQ.B13); n=3378)

Top energy users also perceived a lower than average ability to shift load, as shown in Figure 116, however this was not reflected in the *actual* reported load shifting behaviour during the trial, shown in Figure 117 below.

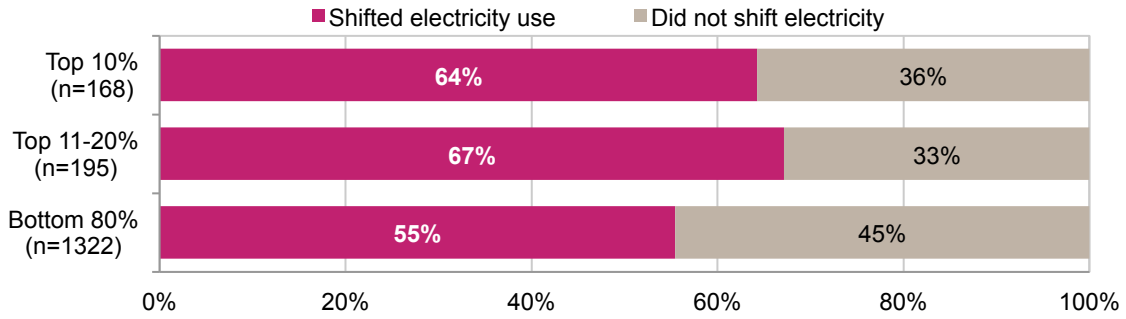
Figure 116: Ability to shift major appliance use, by level of energy usage



Behaviour Change

No significant difference was found in households' self-reported reductions in energy usage during the trial for the top 20% of energy users compared to other households. The top energy users more often reported shifting their time of energy use in the trial (Figure 93), with the 11–20th percentile group responding slightly more than the top 10%. This result shows a very similar pattern to energy bill vulnerability in Figure 115 above suggesting an association between bill vulnerability and actual behaviour change.

Figure 117: Reported load shifting, by level of energy usage

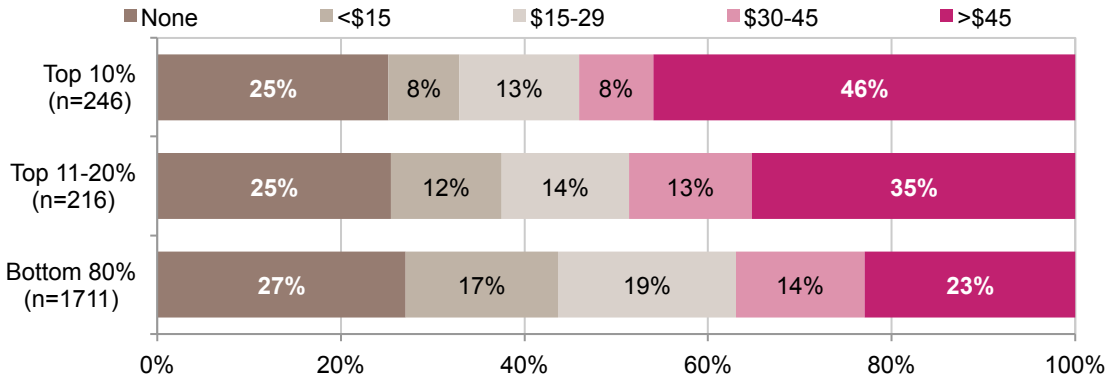


From responses to: For Network respondents, "As a result of a peak event did you receive any rebates (to the credit card provided for the trial)?" For Retail respondents, "Did you reduce your electricity consumption during the peak pricing event?" (Q.C5d; n=1685)

Perception of savings

Top energy users, particularly the top 10%, were more likely to record higher financial savings from the use of their products, as shown in Figure 118. With higher discretionary energy use, it is logical that greater energy and bill savings potential exists for this group.

Figure 118: Perception of savings, by level of energy usage



From responses to 'How much money do you think your product saved you off each electricity bill during the trial?' (Q.C14; n=2173)

Product Conclusions

Whilst the 2013 survey analysis showed a product preference for SeasonSmart from the Top Energy User group, the results for the 2014 survey (with its larger sample size) did not support this finding. No other significant differences were found between high energy users and the rest of the sample in regard to any other indicator, including product satisfaction and likelihood to recommend.

5.3 PARTICIPANT PERCEPTIONS/EXPERIENCES AND ACTUAL SAVINGS

The analysis above explores survey respondents' own perceptions of their product engagement, their awareness and control over energy data, the behaviour change impacts of their products, their financial savings, their product satisfaction, and a range of other measures.

To complement this, reported perceptions recorded in the survey were cross-referenced with data on actual energy, peak and bill savings. A set of research questions was constructed covering the areas of the survey results most relevant for comparison to actual savings data.

Individual household level savings data estimates were then modelled by Frontier Economics and provided to ISF.[119] See the Data Methodology Report on the ICH website[120] for more detail on the process of calculating household level savings.

Note that there was a medium to high degree of uncertainty in the household level savings estimates due to the lack of 12-months of pre-trial period smart meter data for some households to establish a clear consumption baseline, and of detailed data on other factors that affect household consumption such as occupancy or lifestyle changes. These factors increase the difficulty in isolating the effect of trial factors on savings.

Table 20 provides a summary of the research questions and associated findings. A number of the selected research questions could not be answered due to the limitations mentioned above. Nonetheless, some significant findings were made.

The term 'actual savings' is used for simplicity, but note that this means 'modelled estimates of actual savings', which carry the above caveats regarding limitations.

Table 20: Summary of perception/experience versus actual savings research questions

Research Question	Result
Taking action and actual savings	
1. **Reducing appliance use:** Did respondents who reported reducing their electricity use have greater overall savings than those who didn't? And were particular energy saving actions associated with higher overall savings?	**Partly significant**
2. **Shifting appliance use:** Did respondents who reported shifting their electricity use have greater peak savings than those who didn't? Were particular types of time shifting actions associated with higher peak savings?	**Significant**
3. **Participating in peak events:** Did respondents who reported participating in peak events have higher peak event savings than those who didn't? Were particular sorts of peak event actions associated with higher peak event savings?	**Significant**
Product experiences and actual savings	
4. **Product engagement: Was** greater engagement with feedback	**Significant**

[119] In addition, actual (not modelled) data on the amount of the rebates received by each individual participant with a Network Peak Rebate product (N4 and N6) was provided by Ausgrid and collated by Frontier.

[120] https://ich.smartgridsmartcity.com.au/

Research Question	Result
devices associated with greater overall and peak savings?	
Perception of savings and actual savings	
5. **Perceived savings:** How accurate were customer perceptions of their bill savings compared with their actual bill savings?	**Partly significant**
6. **Satisfaction with savings:** Was the level of actual bill savings/rebate received associated with peak event respondents' satisfaction with the available savings/ rebate (i.e. did they consider their savings during peak events to be worth the effort?) And was there a particular threshold for savings/rebate at which point taking action was more likely to be considered worthwhile?	**Significant**

Each question is discussed individually below, using one or more of the following types of actual savings:

- **Overall savings:** average kWh savings per day over the trial period (*kWh/day)*
- **Peak savings:** average kWh per day savings from 2-8pm (*kWh/day peak)*
- **Peak event savings:** average kWh savings per peak event (*kWh/ hour during event)*
- **Bill savings:** average dollar savings per quarterly bill *($/bill)*
- **Rebate received:** average rebate received per peak event *($/event)*[121].

All graphs use only the bold text as shorthand to describe the metric being used.

5.3.1 Behaviour change and actual savings

The first part of this analysis looks at whether there was a relationship between the actions that respondents report taking and the actual electricity and bill savings they made.

5.3.1.1 Engagement with feedback devices and actual savings

Was greater engagement with feedback devices associated with greater overall and peak savings?

This question looked at whether there was a relationship between the frequency with which respondents who had a feedback technology engaged with it, and the level of overall and peak savings.

Analysis found that those who reported engaging with their feedback technology daily or 2-3 times per week had both higher overall savings (Figure 129) and higher peak savings (Figure 130), than those who only engaged with it weekly or less often.[122] This has

[121] Note that some peak events ran for 2 hours while others ran for 4 hours, affecting the amount of electricity that can be saved in this time and therefore the potential rebate. Therefore longer peak events are likely to automatically attract larger rebates than shorter events. This affects the average rebate per event.

[122] T-test, p=0.008 (Daily+2-3/week), p=0.009 (Weekly or less often). Peak event savings were also tested but had anomalous results: those who reported not engaging frequently with their technology throughout the trial had slightly higher peak event savings (0.22 kWh/peak event) than those who did engage frequently with their technology (0.08 kWh/peak event). This may be due to the mismatch between discrete peak event days requiring action and persistent engagement with technology without incentive.

important implications for product design, i.e. reducing barriers to user interaction, allowing maximal engagement will result in higher overall savings. For example, the Portal may deliver better savings results if regularity of engagement could be increased through the availability of a dedicated tablet app (as tablets gradually become more commonplace) that is more readily accessible than a computer and does not require the user to log in every time. Such an app is, however, likely to be less useful or accessible to some vulnerable demographic groups such as financially vulnerable or pensioner households.

Figure 119: Engagement with feedback technology vs. overall savings

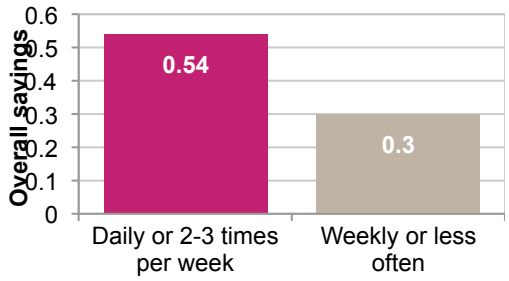
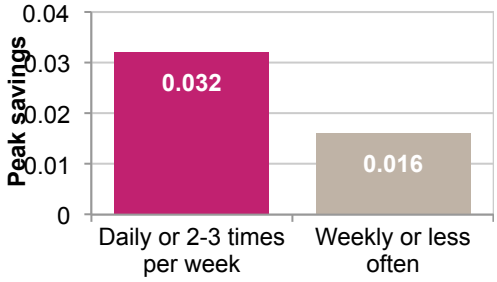


Figure 120: Engagement with feedback technology vs. peak savings



From responses to C2 Frequency of engagement with feedback technology (4.1.2.2) and Frontier's estimated overall and peak savings.

5.3.1.2Reducing appliance use and overall savings

Did respondents who reported reducing their electricity use have greater overall savings than those who didn't? And were particular energy saving actions associated with higher overall savings?

This question looked at whether there was a difference in 'overall savings' (average kWh/day) of respondents who reported taking action to reduce their appliance use compared to those who didn't, and whether the types of actions that respondents reported taking for their various appliances were associated with higher or lower overall savings.

There were observable differences in the overall savings between the two groups, with those saying they took action to reduce electricity use of their appliances having a slightly higher average overall saving than those who didn't, however the differences were not statistically significant. This is likely due to the large variation in what constitutes 'reducing use' and therefore a large variation in the level of savings achieved by households in this group.

The different reduction actions reported by respondents were then grouped into the following categories[123] and compared to overall savings:

- Reduced usage of big appliances

[123] Big appliances were: air-conditioner, heater, clothes dryer, pool pump, and for upgrades only, refrigerator. Small appliances were: lighting, TV, computers, other home entertainment, dishwasher, washing machine, iron, kettle, oven/stove, microwave, shower/bath, and for reducing use, refrigerator. Note the decision to exclude refrigerator from big appliances for reducing usage is based on the assumption that participants would consider 'reducing usage' to be opening the fridge door less, not turning off at the power point, and therefore would not result in big electricity savings.

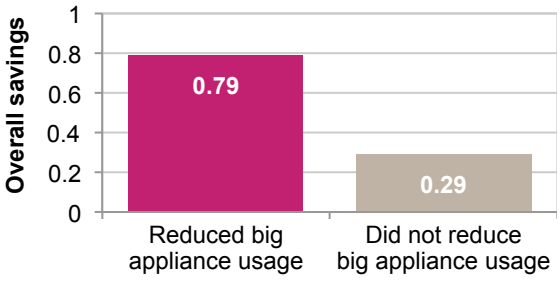
- Reduced usage of small appliances
- Upgraded big appliances
- Upgraded small appliances.

Only the reduction of big appliance usage was found to have a statistically significant effect on overall savings, with those who reported reducing the duration or intensity of big appliance use having overall savings over two-and-a-half times greater than those who did not (Figure 121).[124] Amongst the big appliances, no specific appliances were found to have an individual statistically significant effect on savings, though 'reduced heating' was just outside the significance threshold.[125]

Note that the reported savings being above zero for households who claimed not to have taken any big action is likely a reflection of the 'noise' in the data discussed above.

Interestingly, amongst those who did not reduce the use of big appliances, there were no differences in overall savings between those who reduced the use of at least one small appliance, and those who did not reduce appliance use at all. This does not imply that these actions were meaningless, but that they were not sufficiently effective to rise above the noise in the dataset. This analysis suggests that focussing actions on a few large energy using appliances drives more savings than changes made to the use of a range of smaller appliances.

Figure 121: Type of action to reduce energy use vs. overall savings



From responses to QC.17 Energy saving and load shifting actions (Section 4.2.1.1) and Frontier's estimated overall savings.

5.3.1.3 Shifting appliance use and peak savings

Did respondents who reported shifting their electricity use have greater peak savings than those who didn't? And were particular types of time shifting actions associated with higher peak savings?

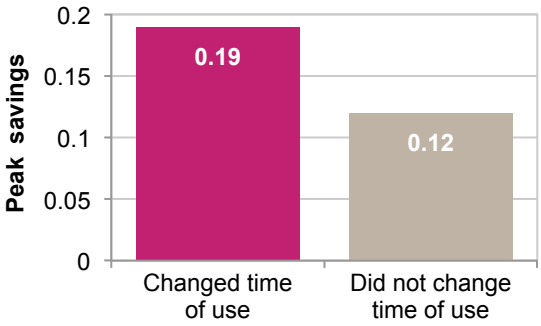
This question looks at whether there was a difference in 'peak savings' (electricity savings during 2-8 pm peak periods, measured in kWh/day peak) between respondents who reported shifting their appliance use outside peak times and those who didn't, and whether the type of actions that respondents reported taking for their various appliances were associated with higher or lower peak savings.

[124] T-test, p=0.019. Any observable differences for the other actions are a function of people in those groups also reducing big appliance usage. Analysis was unable to determine if any particularly big appliance contributed more to these savings.

[125] T-test, p=0.0593. Not significant at chosen significance threshold of p<0.05, but is significant at p<0.1.

Those who reported shifting the time they used their appliances had higher peak savings than those who reported not shifting (Figure 122).[126]

Figure 122: Taking action to shift energy use vs. peak savings



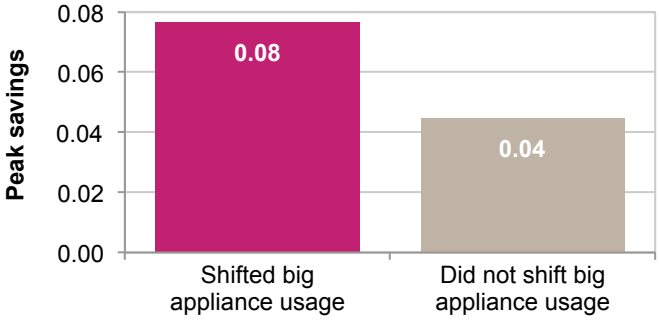
From responses to QC.17 Energy saving and load shifting actions (Section 4.2.1.1) and Frontier's estimated savings during afternoon peak (2pm-8pm).

The different shifting actions reported by participants were then grouped into the following two categories[127] and compared to peak savings:

- Shifted usage of big appliances
- Shifted usage of small appliances.

As with reducing use above, only the shifting of big appliance usage was found to have a statistically significant effect on peak savings, with those who reported reducing the duration or intensity of big appliance use having higher average peak savings than those who did not.[128] Considering each of the big appliances separately, shifting of clothes dryer usage was found to have a statistically significant contribution to peak savings, while shifting of pool pump was almost significant, suggesting these actions were most influential in driving reductions.[129]

Figure 123: Type of action to shift energy use vs. peak savings



[126] T-test, p=0.002.

[127] Big appliances were: air-conditioner, heater, clothes dryer, pool pump, and – for upgrades only – refrigerator. Small appliances were: lighting, TV, computers, other home entertainment, dishwasher, washing machine, iron, kettle, oven/stove, microwave, shower/bath, and for reducing use, refrigerator. Note the decision to exclude refrigerator from big appliances for reducing usage is based on the assumption that participants would consider "reducing usage" to be opening the fridge door less, not turning off at the power point, and therefore would not result in substantial electricity savings.

[128] T-test, p=0.007.

[129] T-test, p=0.019 (Clothes dryer), p=0.092 (pool pump/filter).

From responses to QC.17 Energy saving and load shifting actions (Section 4.2.1.1) and Frontier's estimated savings during afternoon peak (2pm-8pm).

5.3.1.4 Peak event participation and peak event savings

Did respondents who reported participating in peak events have higher peak event savings than those who didn't? Were particular sorts of peak event actions associated with higher peak event savings?

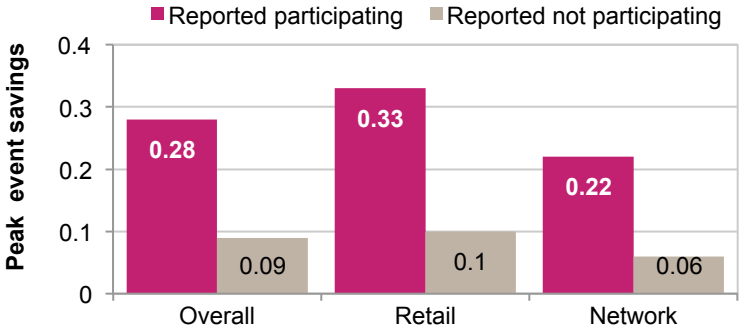
Similar to the above questions, this question looked firstly at whether there were differences in the levels of 'peak event savings' (average kWh/hour during event) between those respondents who reported participating in a peak event and those who didn't. The different types of actions that respondents reported taking during peak events were then analysed to see if they resulted in higher or lower peak event savings.

Those who claimed to participate in peak events had peak event savings that were around three times higher than those who said they did not participate (Figure 124).[130] Note, however, that as with overall savings, even those who claimed not to participate in a peak event still on average made savings. This likely reflects some inaccuracies in the estimated peak savings data, but may also reflect respondents who claimed that the reason they did not participate in peak events was that they were not home during the event. As the trial operator managing the peak event cannot tell the difference between households where people were not home, and those that were home but do not use any power (except to the extent that their 'baseline usage' in the rebate calculation takes account of them consistently not being at home during peak periods), absence was effectively equivalent to participation (see Section 4.1.3.2).

Figure 124 also shows a higher level of peak event savings for the retail Dynamic Peak Pricing products relative to the network Peak Rebate. This is the opposite of what we would expect looking at the customer perceptions of bill savings by pricing/incentive type presented in Section 5.1.2.2 of this report. The Peak Rebate outperformed Dynamic Peak Pricing in terms of perceptions of bill savings, satisfaction and likelihood to recommend the product to a friend. This suggests that the nature of the Peak Rebate product design makes savings more tangible to customers relative to quarterly billed tariff products, resulting in perceived savings that are not fully reflective of actual savings. It is possible that this gap may be closed with more regular billing cycles for Dynamic Peak Pricing products, as this would reduce the time lag between taking action and seeing financial rewards.

[130] T-test, $p<0.001$ (Overall, Retail and Network).

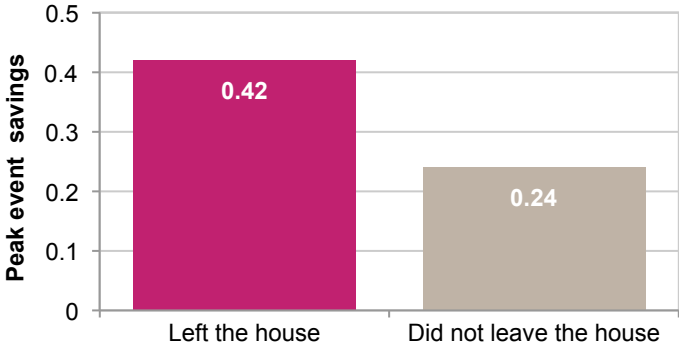
Figure 124: Participating in a peak event vs. peak event savings



From responses to TQ.C5d Self-reported participation in peak events (Section 4.1.3.1) and Frontier's estimated peak event savings.

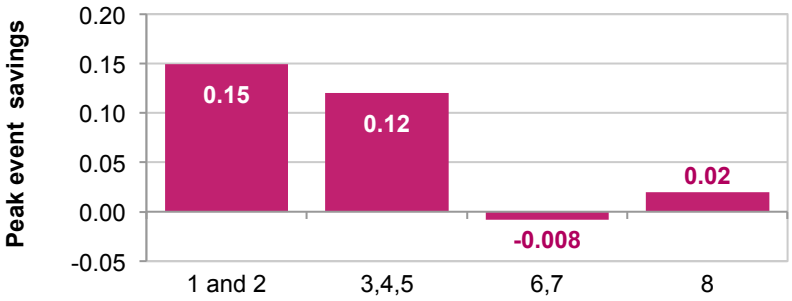
When looking at the types of actions that respondents took during peak events, only the action 'turned everything off and left the house during the peak event' (Action 2) had statistically significantly higher peak savings than other actions (Figure 125).[131] However, when actions were grouped according to magnitude of potential savings, it was found that 'turning off the refrigerator' (only applied by 6% of households), 'not using major appliances that day' and 'waiting till after the peak event ended to use major appliances' (Actions 3, 4 and 5) also contributed to higher peak event savings (Figure 126).[132]

Figure 125: Peak event savings for respondents who left the house



From responses to Q.C18d Actions undertaken during peak events (Section 4.2.1.5) and Frontier's estimated peak event savings.

Figure 126: Peak event savings by peak event actions



[131] T-test, p<0.001.

[132] T-test, p<0.001 (Actions 1 & 2), p=0.005 (Actions 3, 4 & 5).

Key to actions: 1. Turned off electricity at the mains, 2. Turned everything off and left the house during the peak event, 3. Turned off refrigerator, 4. Did not use other major appliances that day, 5. Waited until after the peak event ended to use other major appliances, 6. Did not use smaller appliances that day, 7. Waited until after the peak event ended to use smaller appliances, 8. Other.
From responses to Q.C18d Actions undertaken during peak events (Section 4.2.1.5) and Frontier's estimated peak event savings.

5.3.1.5 Willingness to shift on extreme weather peak events and peak event savings

This question aimed to identify whether there was an association between respondents' reported willingness to reduce their cooling or heating on extremely hot or cold days, and the level of peak event savings they received on such event days. Participants were placed into one of two groups for hot event days based on which of the following two statements they selected:

1. I would use my air-conditioner less to save money, no matter how hot the day
2. I would use my air-conditioner less only on a moderately hot day, but would pay more to cool my home on extremely hot days.

Participants were similarly grouped into two groups for cold event days based on which of the following two statements they selected:

1. I would heat my house less to save money, no matter how cold the day
2. I would heat my house less only on a moderately cold day, but would pay more to heat my home on extremely cold days.

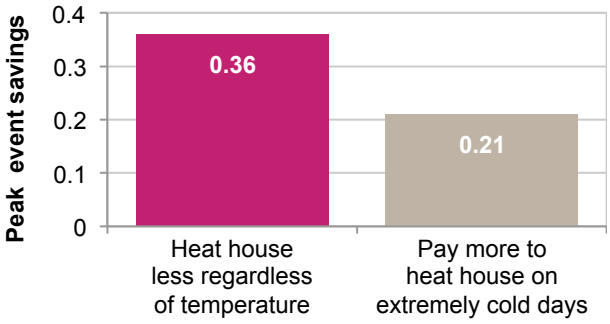
Analysis found no relationship between reported willingness to reduce cooling on extremely hot days and level of peak event savings on days when the average event temperature exceeded 28 degrees or 30 degrees.[133] However, we suggest that none of the peak event days during the trial period were sufficiently hot to really test this analysis. A minimum temperature threshold in the low- to mid-30s may be required to truly test this relationship.

However, for cold event days those respondents who said they would pay more to heat their house on extremely cold days did show slightly lower peak event savings across peak event days when the average event temperature was 16 degrees or less (Figure 127).[134] This suggests that customer perceptions of their likely behaviour were reflected in their actions on winter peak event days.

[133] Analysis was run twice: firstly for the two event days where the average temperature was greater than 30 degrees (Dynamic Peak Rebate Event 41 and Dynamic Peak Rebate Event 48), and secondly for the same two events plus an three additional events where the average temperature was between 28 and 30 degrees (Dynamic Peak Rebate Event 40, Dynamic Peak Rebate Event 46 and Dynamic Peak Pricing Event 47).

[134] T-test, p=0.028. Analysis was run for the two event days where average temperature was 16 degrees or less (Dynamic Peak Rebate Event 50 and Dynamic Peak Rebate Event 51).

Figure 127: Stated response to extremely cold days vs. peak event savings on cold event days



From responses to Q.C5d4 Proportion of households who would respond to peak event on extreme temperature days (Section 4.1.3.3) and Frontier's estimated peak event savings.

5.3.2 Perception of savings and actual savings

The first part of this analysis looks at whether there was a relationship between respondents' perceptions of their savings and the actual bills savings they made.

5.3.2.1 Accuracy of customer perceptions of bill savings

How accurate were customer perceptions of their bill savings compared with their actual bill savings?

This question looked at the bill savings (average $/quarterly bill) received by respondents according to the level of bill savings they perceived they had made. Participants with the Network Peak Rebate products were excluded from this overall analysis, as they received their incentive through a separately calculated rebate on a credit card. They are discussed separately below.

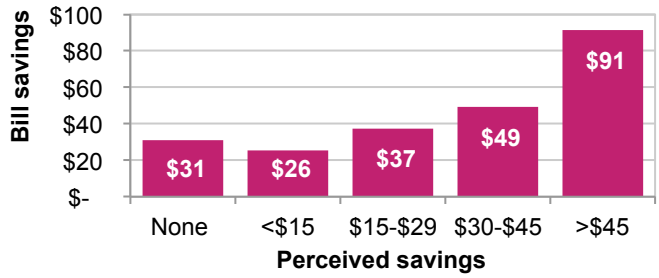
The results of the analysis are shown in Figure 128 below, with actual bill savings on the vertical axis and perceived savings on the horizontal axis. Significant differences were found between those with the lowest and highest perceptions of savings: excluding those who thought they saved nothing, those who thought they saved less than $15 had the lowest level of savings, while those that thought they saved >$45 had the highest level of bill savings.[135] Further, the average actual bill savings for each group (noting the caveats surrounding the calculation of actual savings estimates) were in all cases above the perceived level of savings.

This suggests that respondents were able to roughly gauge the level of savings they were receiving on their bill, although they tend to underestimate the actual level of savings by a reasonable margin. This may be due to the infrequent billing cycle (quarterly for retail trial products except in the case of BudgetSmart), reducing customers' ability to accurately connect behavioural changes made to bill savings received.

It is not clear whether the result for respondents who thought they saved nothing actually was a statistical anomaly due to inaccuracies in the savings dataset, or a real effect based in customer misperceptions.

[135] Anova test, $p<0.001$

Figure 128: Perceived savings vs actual quarterly bill savings



From responses to QC.14 Perception of savings (Section 4.2.3) and Frontier's estimated average bill savings per day multiplied by 91.25 days. NB. Participants with the Network Peak Rebate products (N4 and N6) are excluded from this analysis.

In order to investigate how respondents with the Peak Rebate product understood their rebate savings, perceived 'bill' savings for this group were compared to both their average bill savings (average $/quarterly bill) (Figure 129) and the average level of rebate they received per event (average $/event) (Figure 130).

The findings for actual bill savings were not statistically significant and no clear trend was observable, but interestingly the findings for the average rebate received echoed the pattern observed in Figure 128. That is, excluding those who thought they saved nothing, those who perceived lower levels of savings received lower average rebates per event, while those who perceived higher savings received higher average rebates per event. [136] Interestingly, rebate customers tended to overestimate the savings their products delivered, which is the reverse of that observed for peak pricing products.

Note that no direct comparison can be made between the size of the rebate perceived ($ per event) and perceived level of savings ($ per quarter) as different respondents participated in different numbers of events and so it was not possible to suggest whether rebate customers' perceptions were more accurate than Dynamic Peak Pricing customers' perceptions.

Figure 129: Perceived vs actual *bill* savings for Peak Rebate respondents
(Not Significant)

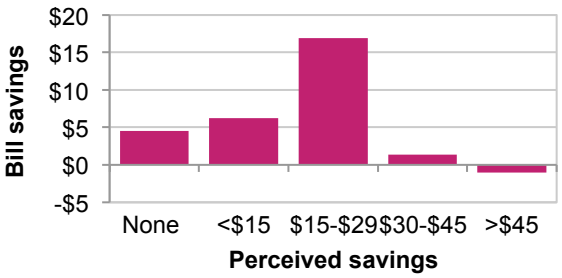
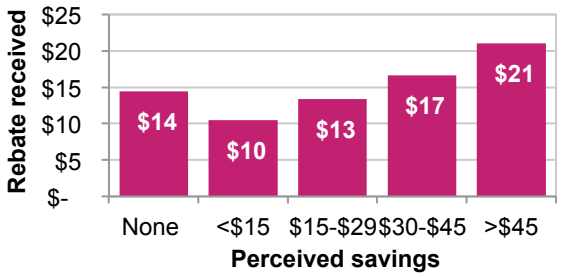


Figure 130: Perceived vs actual *rebate* received for Peak Rebate respondents



From responses to QC.14 Perception of savings (Section 4.2.3) and Frontier's estimated average bill savings per day multiplied by 91.25 days and Frontier's estimated average rebate per peak event. NB. For respondents with Network Peak Rebate products (N4 and N6) only.

[136] Anova test, p<0.001

5.3.2.2 Relationship between satisfaction with available peak event savings/rebate and actual peak event savings

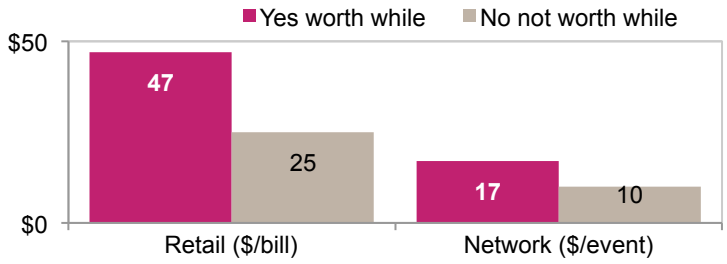
Was the level of actual bill savings/rebate received associated with peak event respondents' satisfaction with the available savings/rebate (i.e. was it worth their efforts in reducing energy during the peak event)?

This question looked separately at the level of bill savings ($/quarterly bill) received by retail participants and the level of rebate received ($/event) by network respondents, and in each case compared these to whether the respondents indicated that these savings/rebates were worth the effort it took to change their behaviour.

Both retail and network respondents who thought that the level of available bill savings or rebate was worth their effort in participating in the event showed significantly higher peak event savings (Figure 131).[137]

It was not possible to establish from the data the direction of this association. That is, it was not possible to establish whether respondents' opinions on the adequacy of the level of savings/rebate offered influenced the amount of action they took and therefore the savings they received; or whether the actual amount of savings/rebate they received contributed to respondents' opinions on the adequacy of the level of savings/rebate offered.[138]

Figure 131: Bill savings/rebate of those satisfied compared to those not satisfied



From responses to Q.C5b Minimum rebate per event desired to motivate Network peak event participation (Section 4.1.3.3) and Frontier's estimated average bill savings per day multiplied by 91.25 days and Frontier's estimated average rebate per peak event.

[137] Anova test, p<0.001

[138] The survey question asked participants about the level of ***available*** savings/rebate, rather than their actual savings/rebate. However the question was asked at the end of the survey, and so it is not possible to distinguish whether participants have conflated the two in answering the question.

6

Conclusions and Recommendations

6.1 CONCLUSIONS

The customer research survey successfully obtained customer perspectives from almost half of all households participating in the trial. Overall, a high level of satisfaction with the customer application products was found, with customers generally obtaining higher levels of engagement and benefit from products when a pricing/incentive structure was combined with a feedback technology.

Home Energy Monitors saw better customer engagement with energy data than online portals due to their high visibility in the home, which resulted in improved awareness and customer ability to reduce bills.

The most popular products tended to be those involving discrete 'peak events' – PriceSmart and the Dynamic Peak Rebate – but the BudgetSmart products focussing on regular proactive customer engagement with billing were also successful. The data shows large variations in the experiences of different people with the same product, which suggests that there will not be one product that suits all customers. Diversity in product offerings is likely to be required to allow customers to choose the products they think best suit their needs.

This diversity of experiences to some extent obscured meta differences between product types or broader product groups. However, when analysing responses by demographic variables, subtle but interesting differences emerged. The data suggests that financially vulnerable households and households with children have greater than average engagement with the customer app products and obtain financial benefits and satisfaction from their use. Elderly households engaged less with the technology, and derived fewer benefits and satisfaction as a result. However, low income elderly households (pensioners), responded more positively to customer app products. As long as a voluntary approach is taken, with room for consumer choice, these results suggest that time of use pricing appears to present a benefit rather than a threat to financially vulnerable households.

Finally, the comparison of actual savings with customer perceptions confirms that self-reported customer behaviour changes do correlate with actual delivered savings. Those receiving rebates tended to *overestimate* the value of their financial savings, while those on dynamic tariff structures tended to *underestimate* the financial savings their products delivered. More frequent billing cycles and savings estimation features may help dynamic tariff customers more accurately understand their savings, while caution should be exercised when asking customers directly how much they saved, as this may be influenced by the product type or design.

6.2 RECOMMENDATIONS FOR FUTURE RESEARCH

This project has yielded a rich seam of data interrogating customer responses to feedback technologies and a range of tariff and incentive mechanisms for incentivising consumer reductions in peak demand. Nonetheless, several avenues for further research have been presented:

- **Trial Period/Design**
    - **Extreme events:** Further analysis of peak events run during more extreme weather conditions would be advantageous to better test the reported propensity of customers to deliver peak event savings on the hottest or coldest days.
    - **Actual savings data:** In terms of trial design, comparing actual and perceived savings data would have been more powerful if at least 12

months of pre-trial smart meter data was available for every customer. This would have improved the accuracy of estimates of actual energy, peak demand and financial savings and reduced the statistical 'noise' clouding comparison of customer perception and savings reality.

- **Survey Analysis**
  - **Cross-question analysis:** Due to the substantial amount of data collected from the survey to be analysed in this report, highly detailed cross-question analysis was not possible within the scope. However, there were numerous instances where comparisons of responses to different questions may shed additional light on customer attitudes versus behaviours. For example:
    - A quarter of respondents reported that they didn't need to change their daily routine to implement their energy saving/time shifting actions. It would be interesting to interrogate how many actions these respondents implemented, for which appliances, and whether these respondents made high or low savings.
    - Half of all respondents who reported undertaking some behaviour changes during the trial reported that at the time of the survey they were still implementing all of their changed behaviours. It would be interesting to see how these responses related to actual length of time in trial, as well as the magnitude of changes (and savings) that were implemented.
  - **Multivariate analysis:** This research was restricted to covariate analysis; however, there was evidence of numerous different factors influencing customer behaviours and outcomes to different degrees. Using a multivariate model would allow the analysis to control for variance across several variables, to better isolate the impact of a single variable. For example, isolate the influence of feedback technology type relative to tariff type on customer satisfaction, for example.
- **Survey Design**
  - **Time-series analysis:** The reliability of the time series analysis undertaken in this survey was limited, as customers started using their products at different times, and survey logistics required deployment within a defined survey period. As such, 'change over time' data was unable to deliver clear results. If change in customer experience over time is highly important in future surveys (at the expense of increasing sample size through allowing multiple methods of survey completion), automated online survey methods should be deployed upon trial entry and at regular intervals as desired.
- **Additional Research Questions**
  - Respondents identified cost of bills and reliability of supply as having equal priority (Section 3.2.1). To interrogate the complex trade offs between these two competing priorities would require a more nuanced examination through dedicated choice modelling research.

Additional research items listed above under 'Survey Analysis' could be carried out using the data made available in the Information Clearing House website (https://ich.smartgridsmartcity.com.au/).

7

Appendices

7.1 STAKEHOLDER AND DATA PRIORITIES

The following tables outline how this Customer Research Report addresses the data priorities and stakeholder information priorities defined in the Requirements Traceability Matrix and the Stakeholder Engagement Report.

Table 21: Data priorities met through customer research

Data Priority	Relevant sections of this Report
DCA1. Understand, analyse and report the response and preferences of consumers in relation to particular technologies, tariffs and appliances to maximise energy efficiency outcomes, with particular attention to those whose ability is constrained to adjust their usage patterns (i.e., elderly, low-income consumers, households with small children, consumers on life-support systems).	General analysis throughout Chapter 4 SURVEY RESULTS. Specific analysis of preferences for different types of technologies and tariffs in 5.1 Comparing Product Types and 5.2 Vulnerability Analysis.
DEV2. Analyse and report on consumer response and satisfaction to various elements of the electric vehicle solution e.g. charging location, tariffs, billing, etc.	Electric Vehicles not included in scope.
DSX1. Understand the security risks associated with the Smart Grid network for government agencies, industry and individual consumers arising from the conduct of the Activity.	Specific analysis of security risks not included in scope. Analysis of respondents' privacy and smart meter concerns in Section in 3.2.1 Electricity supply priorities and 3.2.2 Comfort over sharing of electricity data.

The following table outlines how this Customer Research Report addresses the stakeholder information priorities defined during the SGSC stakeholder engagement research conducted earlier in 2013.

Table 22: Stakeholder information priorities met through customer research

Stakeholder Information Priority	Potential Metrics	Relevant sections of this Report
SP4. What would the uptake of smart grid technologies be in a market situation where customers pay for the product? How is this affected by demographics?	Would need to be informed through Choice Modelling Customer Research.	Choice Modelling not included in scope

Stakeholder Information Priority	Potential Metrics	Relevant sections of this Report
SP5. a) What impact did the trials have on consumer behaviour by demographic group? b) Were the impacts enduring or short-term? c) What techniques will sustain behaviour change and retain consumer interest over the longer term? d) How does this compare to other local and international experience?	Perceptions of behaviour change could be more deeply informed qualitatively through Customer Research Survey	a) 4.2.1 Behaviour change and 5.2 Vulnerability analysis. b) 4.2.1.4 Persistence of behaviour change. c) Figure 59: Factors that may increase persistence of respondent behaviour change. d) Outside of scope.
SP6. How would real life consumer responses to smart grid technologies differ from trial experience?	-	Not explicitly included in scope. Comparison of Trial and Control groups (Chapter 3 RESPONDENT PROFILE) could provide insights into differences between trial population and real life consumer population.
SP10. How did different demographic groups respond to offers, and specifically to different marketing techniques?	-	General trial experiences were not included in final version of the Treatment survey. Open responses to 3.2.2 Reason for engaging with trial provides some insights.
SP13. What demographic characteristics made customers more or less likely to take up products or offerings?	-	Demographic analysis of participant and control groups in Chapter 3 RESPONDENT PROFILE. Demographic analysis of participants vs. non-participants not included in scope. Analysis of general demographic characteristics that were related to particular responses to products analysed in Chapter 4 Survey Results. Specific demographic analysis in 5.2 Vulnerability analysis.
SP20. What is the customer's willingness to accept variance in supply reliability?	Would need to be informed through Choice Modelling Customer Research.	Choice Modelling not included in scope.

Stakeholder Information Priority	Potential Metrics	Relevant sections of this Report
SP25. Do smart grids improve customers' energy literacy, particularly as it relates to confidence as a demand side participant?	Could be informed through Customer Research Survey % of respondents feeling more confident to understand and accept offers	4.2.2 Energy awareness, control and literacy.
SP26. What level of interest do customers have in energy data and information? What do customers want and need to know?	Could be informed through Customer Research Survey % of respondents interested in different level of information detail (select from menu)	4.1.2.3 Usefulness of feedback information.
SP29. What emotional responses do smart grids technologies elicit? How does this contribute to public perception?	First part could be informed by Customer Research Survey. Second part qualitative.	General responses to smart grid technologies: 3.2.3 Comfort over sharing of electricity data 4.2.2 Energy awareness, control and literacy 4.3 Product conclusions Understanding core emotional responses underpinning attitudes to smart grid technologies requires more in-depth qualitative research.
SP30. What are the key privacy issues emerging?	List of issues identified during trials. Could be informed by Customer Research Survey from participant and control group perspective.	3.2.1 Electricity supply priorities and 3.2.3 Comfort over sharing of electricity data.

Stakeholder Information Priority	Potential Metrics	Relevant sections of this Report
SP34. Did greater accuracy of customer bills increase satisfaction in trial respondents?	Customer Research Survey	Accuracy of customer bills not included in scope. Higher perceived accuracy of bill estimation features of feedback technologies (Figure 35) showed a clear trend of higher product satisfaction but sample sizes were too small to confirm the statistical significance of the relationship.

Source: SGSC Stakeholder Engagement Report, 2013, ISF

7.2 2013 SURVEY DEPLOYMENT DATA

Table 23: Response rates of 2013 surveys for trial respondents and control group

	Control	Trial Participant
Sample size	1,931	6,410
Surveys completed	241	1,710
Completed survey (%)	12%	27%
Unable to contact (%)	34%	45%
Refused (%)	45%	19%
Did not qualify (%)	2%	1%
Language difficulties (%)	3%	2%
Other (%)	3%	7%
Conversion rate of those who qualified and were contacted (%)	24%	49%

Table 24: Call outcome statistics – control group

Call Outcome	Final count	% of total sample
Total sample	**1931**	
Completed Interview	**241**	**12%**
Soft Appointment	43	2%
Hard Appointment	0	0%
No Answer	21	1%
Engaged	0	0%
Answering Machine	10	1%
Do not qualify - A1- Have not lived at household for at least 12 months	30	2%
Do not qualify- A2B- No one able to answer questions about household energy use	3	0%
Refused	874	45%
Disconnected	334	17%
Language difficulties	66	3%
Business number	7	0%
Name not known	47	2%
Fax Modem	6	0%
Dead Number called more than 15 times	249	13%

Table 25: Call outcome statistics – trial participant respondent group

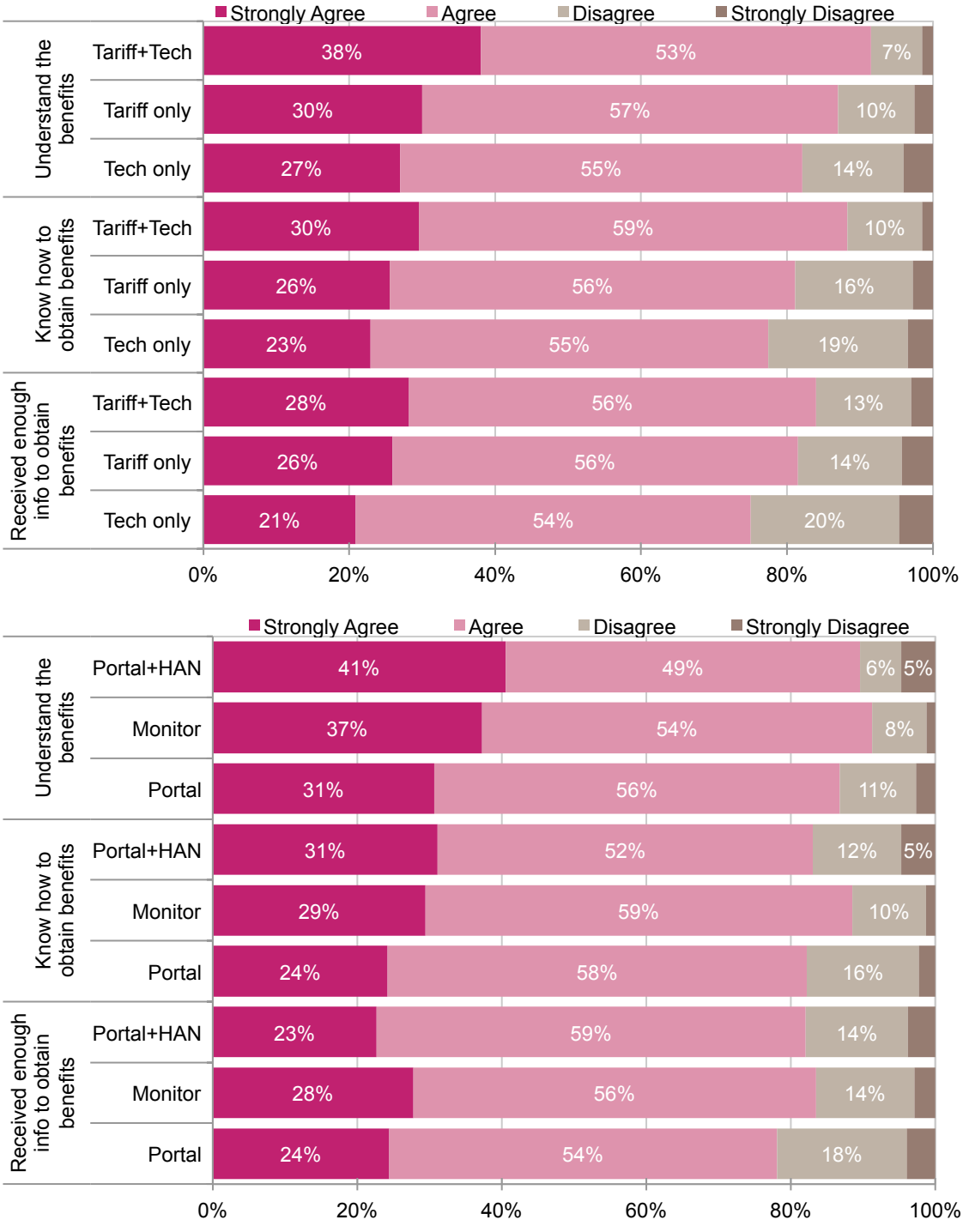
Call Outcome	Total count	% of total count
Total sample	6410	
Completed Interview	1710	27%
Virgin number (not called)/ no Result online	21	0%
Soft Appointment	383	6%
Hard Appointment	0	0%
No Answer	1697	26%
Engaged	20	0%
Answering Machine	417	7%
Do not qualify - Appropriate person does not have time to answer questions on the trialled product	4	0%
Do not qualify- No one available who can answer questions on the trialled products	63	1%
Refused	1227	19%
Disconnected	623	10%
Language difficulties	118	2%
Business number	10	0%
Name not known	69	1%
Fax Modem	14	0%
Dead number called 10 times with no answer	6	0%
Away for duration of study	28	0%

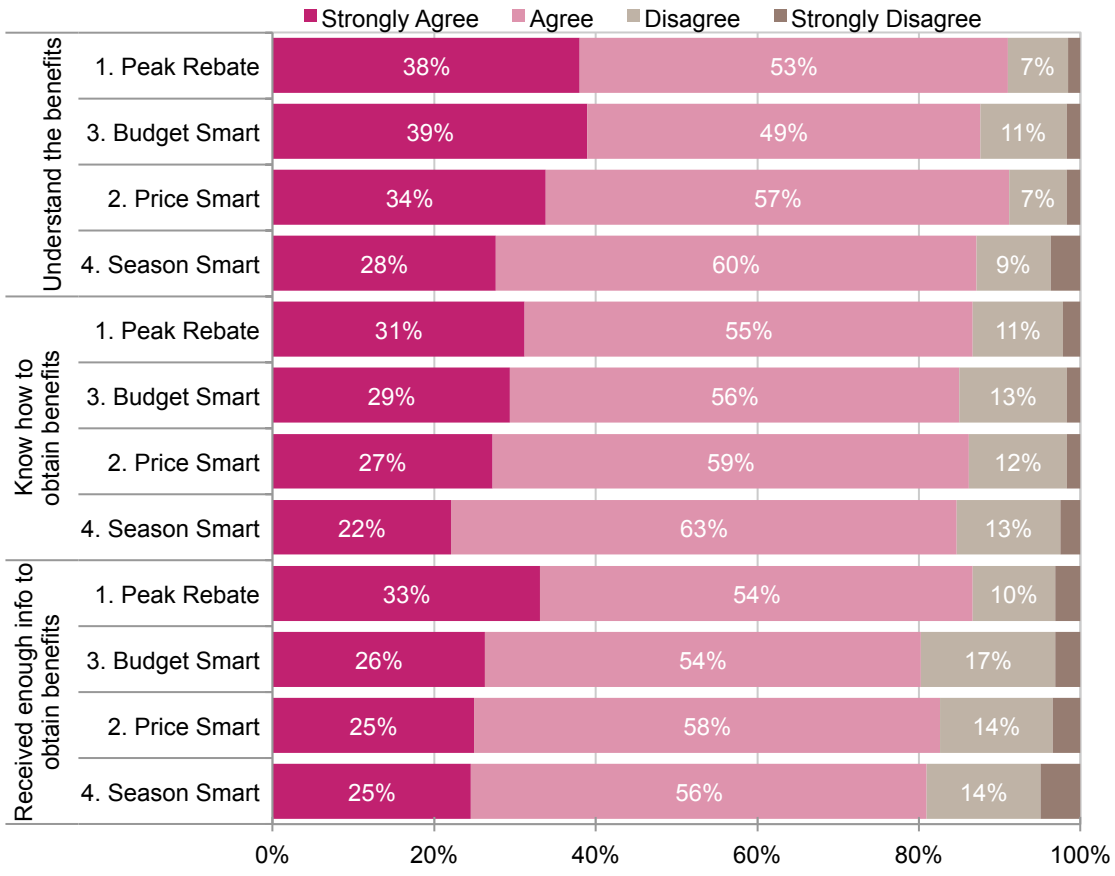
7.3 ADDITIONAL 2014 SURVEY RESULTS

7.3.1 Product Interaction

Figure 132: Participant understanding of trialled products, by product type, technology type and pricing/incentive type

(See Section 4.1.1.)




Strongly Agree
Agree
Disagree
Strongly Disagree
Understand the benefits
1. Peak Rebate
38%
53%
7%
3. Budget Smart
39%
49%
11%
2. Price Smart
34%
57%
7%
4. Season Smart
28%
60%
9%
Know how to obtain benefits
1. Peak Rebate
31%
55%
11%
3. Budget Smart
29%
56%
13%
2. Price Smart
27%
59%
12%
4. Season Smart
22%
63%
13%
Received enough info to obtain benefits
1. Peak Rebate
33%
54%
10%
3. Budget Smart
26%
54%
17%
2. Price Smart
25%
58%
14%
4. Season Smart
25%
56%
14%
0%
20%
40%
60%
80%
100%

7.3.2 Product Impact

Figure 133: Type of reported behaviour change by product

(See Section 4.2.1.2)

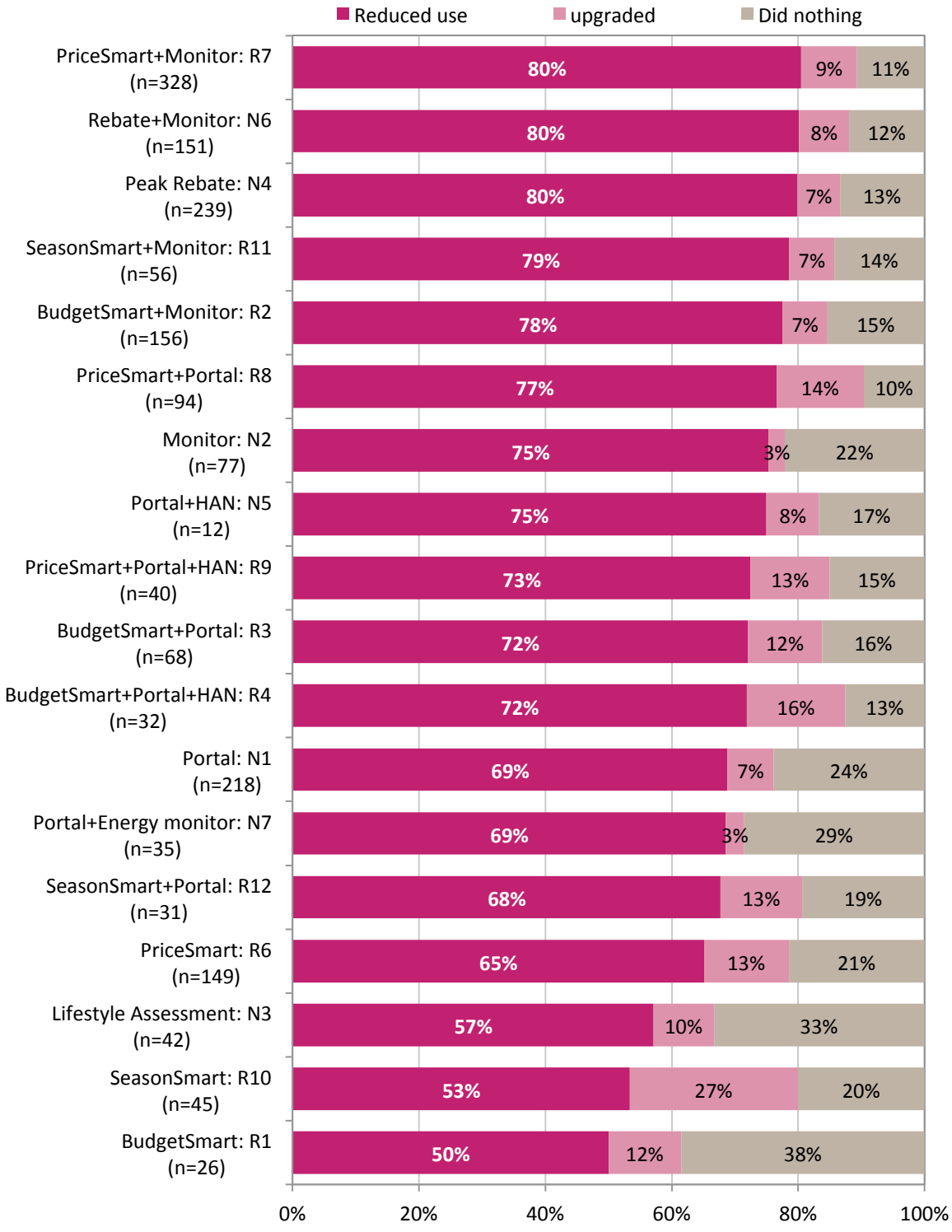
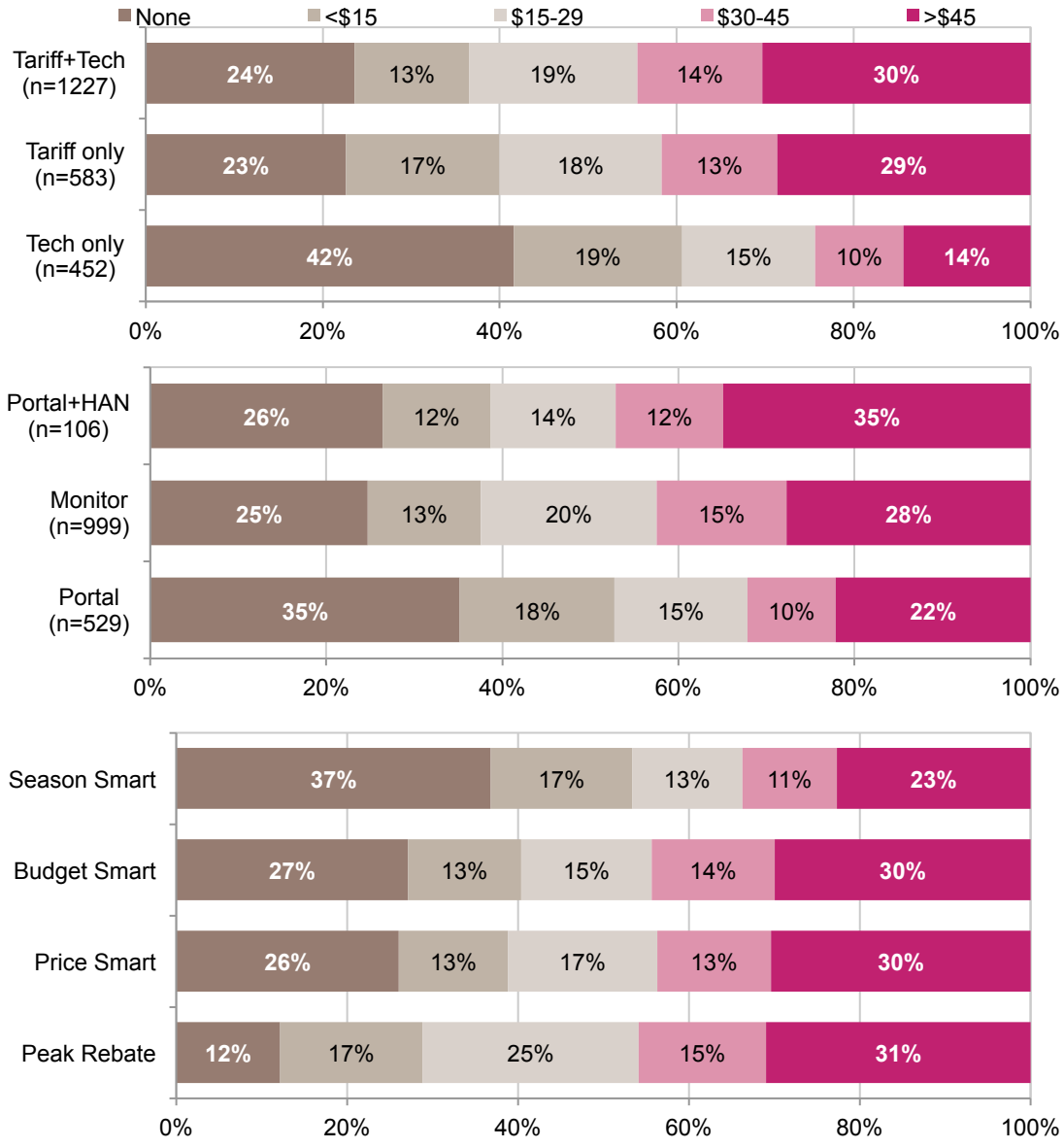
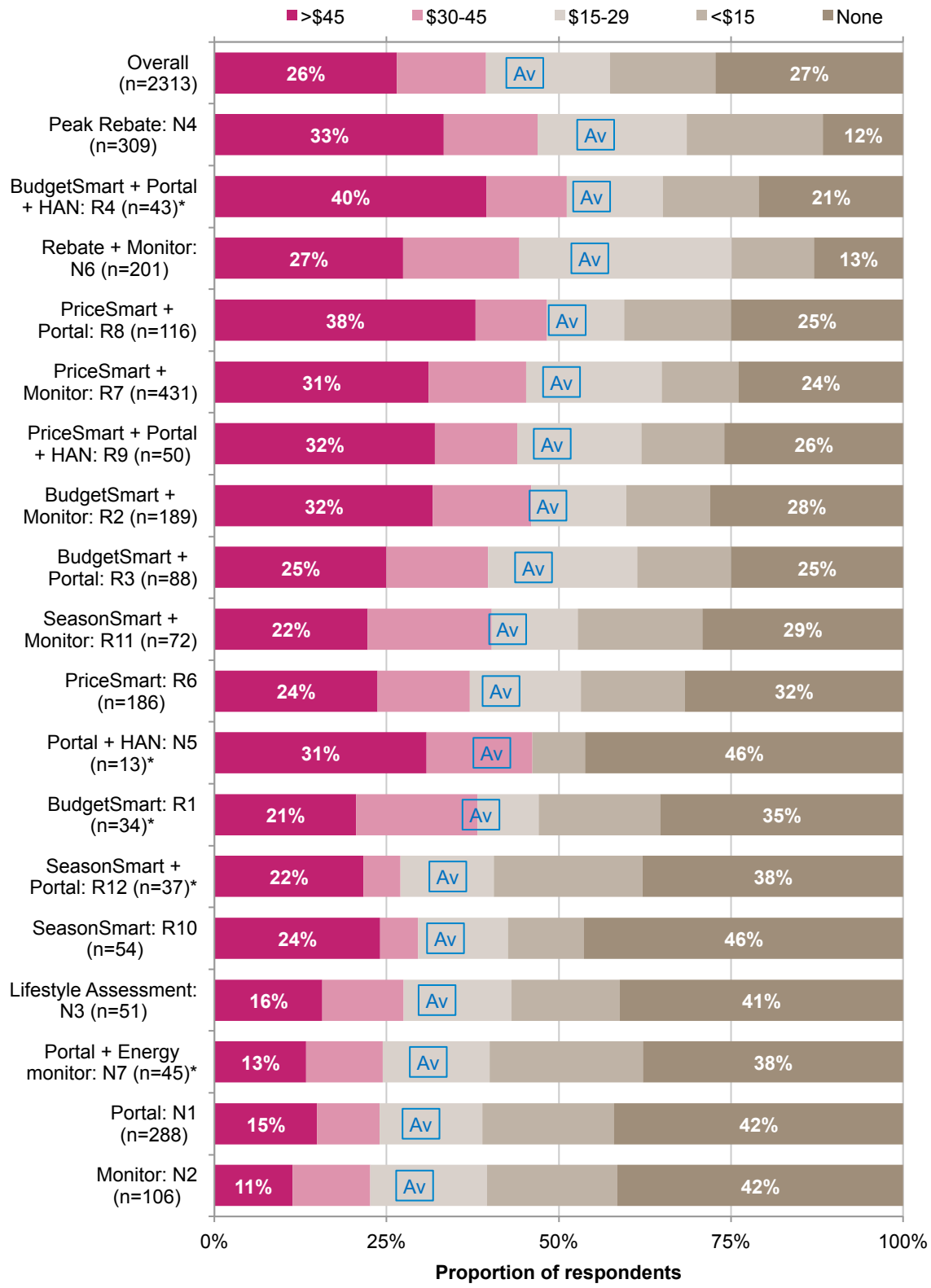


Figure 134: Participant perception of savings from trial, by product type, technology type, pricing/incentive type, and individual product

(From Section 4.2.3.4)





** Sample size is small. Results should be interpreted with caution.*

From responses to: "How much money do you think your product saved you off each electricity bill during the trial? None; Less than $15; $15 to 29; $30 to $45; Over $45". (TQ.C14; n=1420)

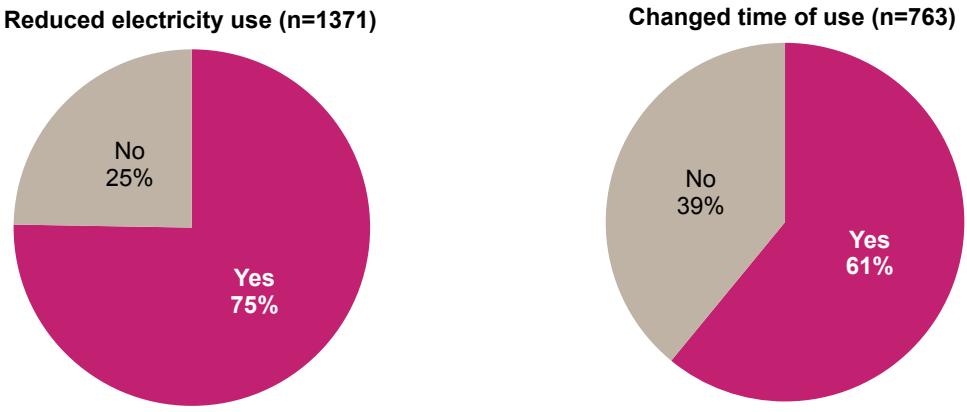
7.4 2013 SURVEY DATA

7.4.1 Energy saving and load shifting

7.4.1.1Prevalence of behaviour change

In the 2013 survey, respondents were asked whether they reduced and/or changed the time of their electricity use because of the trial. Three-quarters of respondents (75%) reported they had reduced their energy use while somewhat less (approximately 60%) reported changing the time of day that they used electricity since starting to use their product (Figure 135).[139]

Figure 135: Self-reported change in amount and timing of electricity use



From responses to: 1) "Since starting to use your product have you and the other people in your home made changes to how much electricity you use?" and 2) "Since starting to use your product, have you and the other people in your home made changes to what time of day you use electricity?". (2013 TQ.C17; n=1371 and 2013 TQ.C18; n=763. 2013 responses only.) NB. Participants in peak event-related trials (products N4, N6 and R6-R9) were not asked Q1. Instead their response was calculated from their responses to the following questions "Did you reduce your electricity consumption during the peak pricing event?" and "Has participating in the peak event(s) had an effect on reducing how much electricity you and the other people in your home use at other times?".

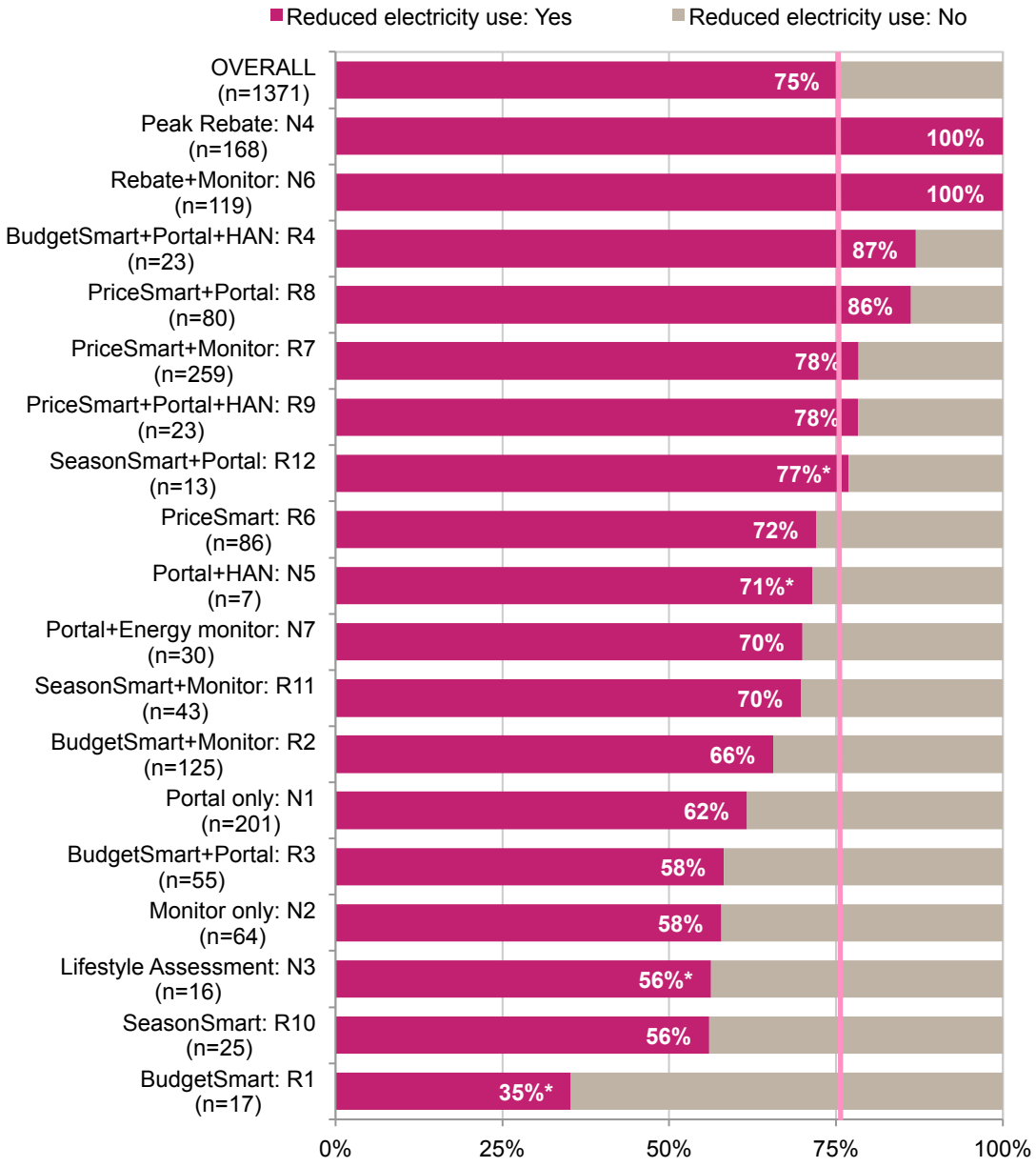
7.4.1.2Behaviour change effect of trialled products

The proportion of respondents trialling each product who reduced electricity use of shifted the time are shown in Figure 136 and Figure 137.

The critical peak products (Network peak rebate, N4 and N6, and Retail PriceSmart tariff, R6-R10) generally showed a higher than average proportion of respondents changing the amount and time of use of electricity as some point during the trial. Similar to Figure 140 (which showed that during peak events, respondents more often reduced their use rather than shifted it), respondents on the critical peak products also more often reduced use rather than shifted it throughout the trial.

[139] Note that the question of whether people had changed the time of day they used electricity was only asked of those customers on a time-of-use tariff, and so had a pricing structure that rewarded general load-shifting.

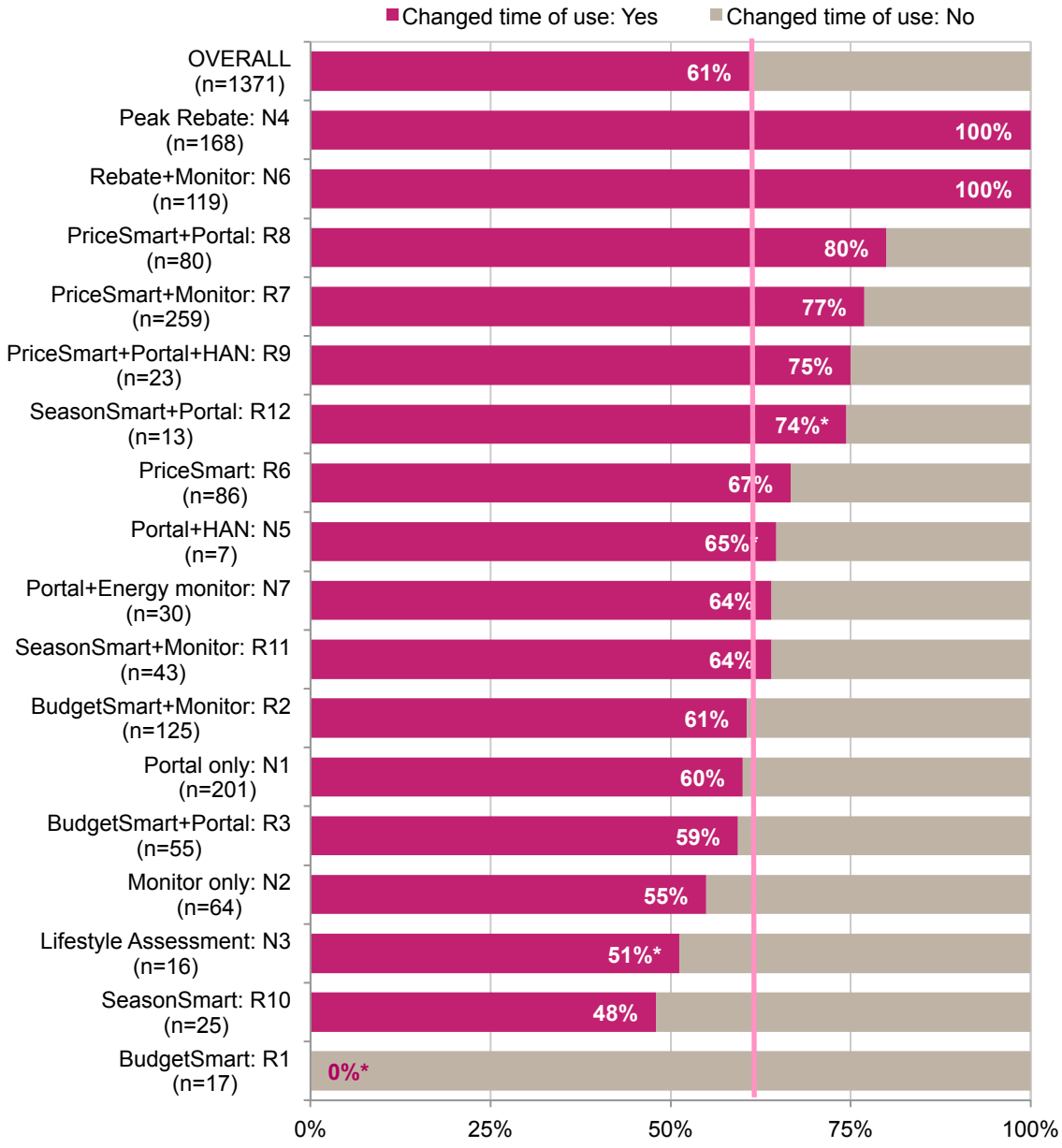
Figure 136: Changed amount of electricity use by respondents, by product



** Sample size very small. Results should be interpreted with caution.*

From responses to: 1) "Since starting to use your product have you and the other people in your home made changes to how much electricity you use?". (TQ.C17; n=1371) NB. Participants in peak event-related trials (products N4, N6 and R6-R9) were not asked this question. Instead their response was calculated from their responses to the following questions "Did you reduce your electricity consumption during the peak pricing event?" and "Has participating in the peak event(s) had an effect on reducing how much electricity you and the other people in your home use at other times?".

Figure 137: Change in time of day of electricity use by respondents, by product



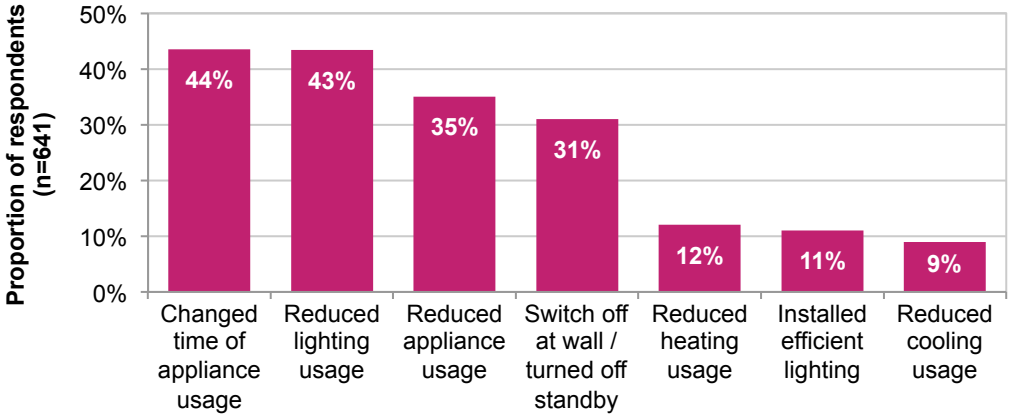
** Sample size very small. Results should be interpreted with caution.*

From responses to: "Since starting to use your product, have you and the other people in your home made changes to what time of day you use electricity?". (TQ.C18; n=763)

7.4.1.3Energy saving actions

Participants who reported that they had taken energy saving actions were also asked what specific actions were taken. Respondents were allowed the freedom of open answers, which have been coded into the main categories shown in Figure 138 below. Of the 75% of respondents who reported taking actions to save energy, each on average reported 2.2 actions, with some respondents listing up to 7 actions.

Figure 138: Most reported energy saving actions

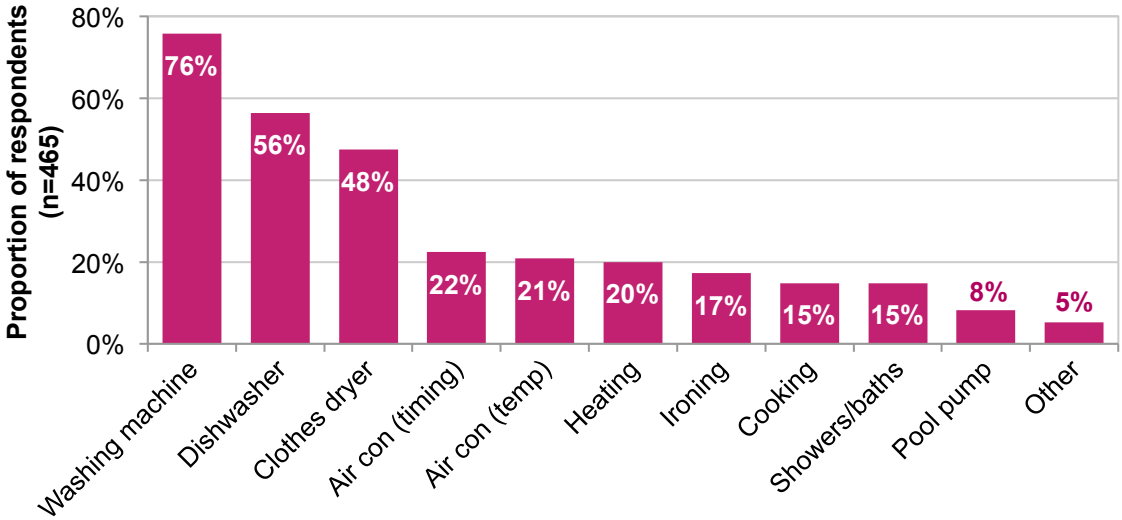


Coded from open response to: "Please list the actions you and the other people in your home took to reduce your electricity use" (2013 TQ.C17b; n=641)

7.4.1.4Load shifting actions

Respondents that answered 'Yes' to changing their timing of electricity use were asked to which appliances this applied (Figure 139). Washing machines were the most common appliance to be shifted to off-peak periods (76%), followed by dishwashers (56%) and clothes dryers (44%). The timing of air conditioning use and changing the thermostat were both reported by around 20% of households responding to this question. This result is not entirely consistent with the results shown in Figure 138 above, which suggests a much lower proportion of households changed thermostats compared to the proportion that changed timing or reduced use. The 'other' category received 63 responses (13%), of which 38 (8%) were load shifting of the pool pump or pool filter. Pool pump/filter should be added as a multiple-choice option in the 2014 version of the survey.

Figure 139: Appliance use most often load shifted

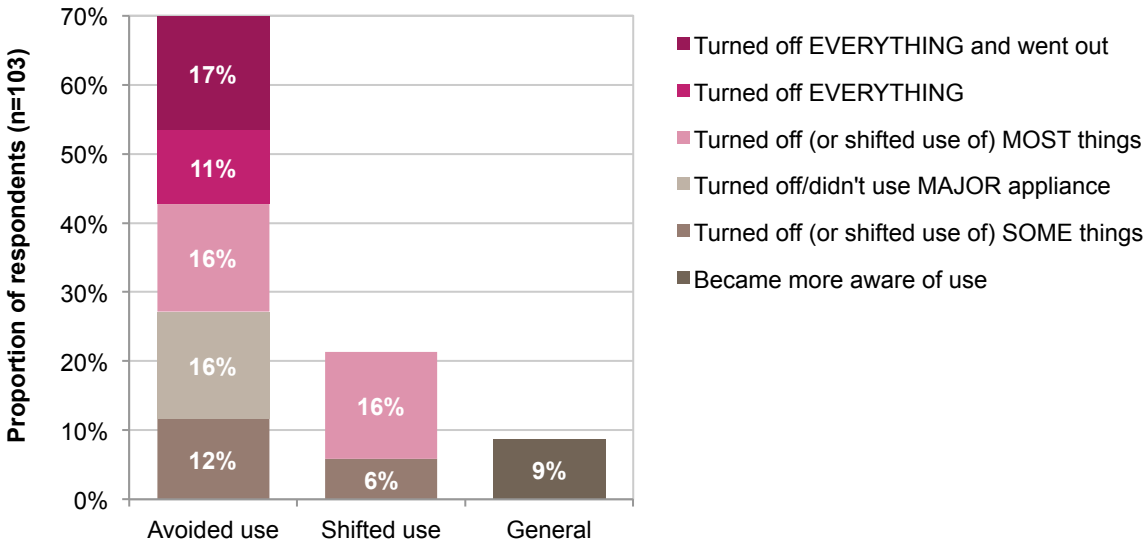


From responses to: "For which of the following appliances or activities did you shift your time of use? You may choose more than one option.". (TQ.C18b; n=465) NB. Responses provided as fixed choice options, aside from "Pool pump" which was coded from open responses to "Other". Responses for "Pool pump" may have been higher if prompted to all respondents.

7.4.1.5Load shifting actions during peak events

The same respondents were also asked to about their behaviour changes specifically relating to peak events (Figure 140). Approximately 70% of respondents indicated that they reduced their energy consumption during this period by turning off or avoiding the use of appliances to some degree. Just over 20% said that they delayed or changed the time of use of appliances to some degree. Just under 10% indicated that the peak event had only a general impact on their behaviour.

Figure 140: Peak event actions



Coded from open responses to: "Now thinking only about peak events, were the behaviour changes you made during this period different from those at other times? If so, how?". (TQ.C18c; n=121) NB. Responses were opened ended and coded into the above categories. Responses from 18 respondents indicated that they misinterpreted the question and so are not represented in the graph above.

7.5 SURVEY QUESTIONS

The following pages show the Survey questions for the control and trial participant groups as administered through the phone surveys.

SGSC Customer Research
-2014 Online Treatment Survey-

The first section of this document outlines instructions for the set-up of the survey the second section of the document is the actual survey.

The questionnaire consists of 4 sections.

A. **Introduction / Screener questions**
B. **Household profiling**
C. **Product experiences**
D. **Wrap up and end of survey**

Survey Set-up Instructions

The survey is being conducted amongst customers who have one of 20 product types and a control group. Specific questions are tailored for individual products (P), these are coded using the numbers below.

Code	Product
1	SGSC Home Energy Online portal
2	SGSC Home Energy Monitor
3	SGSC Home Energy Assessment
4	SGSC Home Energy Rebate
5	SGSC Home Energy Network control system plus SGSC Home Energy Online portal
6	SGSC Home Energy Rebate plus SGSC Home Energy Monitor
7	SGSC Home Energy Online portal plus SGSC Home Energy Monitor
8	BlueGen Gas Fuel Cell
9	RedFlow Battery Storage System
10	BudgetSmart plan
11	BudgetSmart plan with PowerSmart Monitor
12	BudgetSmart plan with PowerSmart Online portal
13	BudgetSmart plan with PowerSmart Online portal & Home Control system
14	PriceSmart tariff
15	PriceSmart tariff with PowerSmart Monitor
16	PriceSmart tariff with PowerSmart Online portal
17	PriceSmart tariff with PowerSmart Online portal & Home Control system
18	SeasonSmart tariff
19	SeasonSmart tariff with PowerSmart Monitor
20	SeasonSmart tariff with PowerSmart Online portal

In the question wording the full name of the product is sometimes used as represented in the table above, these are designated '#_L' (e.g. for the tag '7_L' please use the term 'Home Energy Online plus Home Energy Monitor'). More often a shorter version of the name is used in the question wording designated by the '#_S' tag. These shorter versions are in the table below. Some of the products are a bundle of products and in some cases we need to ask questions of these separately. This is specified as B1, B2, B3. Please insert the relevant wording in these cases from the table below:

Tag	Product	B1 (pricing/ rebate products)	B2 (1st technology)	B3 (2nd technology)
1_S	Online portal		Online portal	
2_S	Energy monitor		Energy monitor	
3_S	Home energy assessment			
4_S	Rebate	Rebate		
5_S	Online portal with home control system		Online portal	Home control system
6_S	Rebate with energy monitor	Rebate	Energy monitor	
7_S	Online portal with energy monitor		Online portal	Energy monitor
8_S	Fuel Cell			
9_S	Battery Storage System			
10_S	BudgetSmart plan			
11_S	BudgetSmart plan with PowerSmart Monitor	BudgetSmart plan	PowerSmart Monitor	
12_S	BudgetSmart plan with online portal	BudgetSmart plan	Online portal	
13_S	BudgetSmart plan with online portal & home control system	BudgetSmart plan	Online portal	Home control system
14_S	PriceSmart tariff			
15_S	PriceSmart tariff with PowerSmart Monitor	PriceSmart tariff	PowerSmart Monitor	
16_S	PriceSmart tariff with online portal	PriceSmart tariff	Online portal	
17_S	PriceSmart tariff with online portal & home control system	PriceSmart tariff	Online portal	Home control system
18_S	SeasonSmart tariff			
19_S	SeasonSmart tariff with PowerSmart Monitor	SeasonSmart tariff	PowerSmart Monitor	
20_S	SeasonSmart tariff with online portal	SeasonSmart tariff	Online portal	

For questions that are designed for all participants but the wording needs to be specifically matched to the participants product we have used [P_L] or [P_S] to indicate whether the long or short version is to be used.

Instructions for survey set-up are included written in red

Survey

Online Survey (Treatment Group) - for New and Repeat Respondents

A. INTRODUCTION/SCREENER QUESTIONS

A0 Introduction EMAIL TEXT – Treatment Group – only where background "RespondentCat" field = 1 or 3

Dear [insert name]

Your household is currently one of a limited group trialling [If P = 1 – 9 'Ausgrid's' if P = 10 – 20 'Energy Australia's'] [P_L] as part of the Australian Government's *Smart Grid, Smart City* initiative. We are now in the process of evaluating the project's success and how it could shape future energy use in Australia, so it is important for us to learn about the experiences of the participating households. When you signed up to [P_L], we mentioned that we would ask you to complete one or more customer surveys during the trial.

[If background "RespondentCat" field = 1] We have developed a short online survey to get a better understanding of how the [P_L] product is working for you.The survey will take approximately 15 minutes and all participants who complete the survey will have the opportunity to win a $3,000 travel voucher or one of two iPad minis by telling us in 25 words or less their best idea for reducing their electricity bills.*

[If background "RespondentCat" field = 3] We are now in the process of evaluating the project's success and how it could shape future energy use in Australia. We note that you chose to opt out of the trial, and as part of trial evaluation it is important for us to understand the experiences of both those that continued with their product, as well as those that opted out. The survey will take approximately 15 minutes and as a thank you for your time, if you complete the survey we will provide you a $20 shopping voucher.

To complete the survey, please go to <<insert link>>. The survey will close on 21st March 2014.

To find out more about the *Smart Grid, Smart City* initiative, please visit: http://www.smartgridsmartcity.com.au/

Your personal information will be kept confidential and only shared with Ausgrid, EnergyAustralia and the research institution undertaking the research for us. Only de-identified survey information will be used in any public documents that are released (i.e. it won't be linked to you). To view our privacy policy, please click here [If P=1-9 please insert a hyperlink to the Ausgrid privacy policy which is at: http://www.ausgrid.com.au/Common/About-us/Privacy-Policy.aspx If P = 10 -20 please insert a hyperlink to the EA privacy policy which is at: http://www.energyaustralia.com.au/privacy]. You can unsubscribe from receiving further survey and marketing information on *Smart Grid, Smart City* by emailing [If P= 1-9 then 'SGSC@ausgrid.com.au' if P = 10 – 20 then 'SGSC@energyaustralia.com.au'].

If you have any questions, please contact us on 1300 922 746 (Mon- Fri 9:00am- 5:30pm up to 28th March 2014).

Regards,

The [If P = 1 – 9 'Ausgrid' if P = 10 – 20 'Energy Australia'] *Smart Grid, Smart City* team

Thanks for making a difference

We appreciate your help with our *Smart Grid, Smart City* trial. The feedback we get from your home, and

thousands of other participants, will help shape the future of energy use in Australia.

[Logo image]

[If background "RespondentCat" field = 1] *Terms & Conditions: Starts 9am (AEST) 10/02/14 & ends 5pm (AEST) 21/03/14. Game of skill. Open to NSW residents aged 18+ who are invited to and complete the survey as part of the *Smart Grid, Smart City* trial. Enter by completing the survey and providing your 25-word or less idea for reducing your electricity bills. One $3,000 travel voucher and two new iPad mini Wi-Fi with retina display 16GB (RRP $479) will be awarded to the most interesting and innovative ideas. Winners will be published on the *Smart Grid, Smart City* website on 25/04/14 and contacted by phone or email. Promoter: Surveytalk ABN 68 073 775 756. Terms and conditions are available at http://www.smartgridsmartcity.com.au/About-Smart-Grid-Smart-City/Upcoming-Survey.aspx

A0b Introduction EMAIL TEXT – REPEAT Treatment Group – only where background "RespondentCat" field = 2 or 5

Dear [insert name]

Your household is currently one of a limited group trialling [If P = 1 – 9 'Ausgrid's' if P = 10 – 20 'Energy Australia's'] [P_L] as part of the Australian Government's *Smart Grid, Smart City* initiative. We are in the process of evaluating the project's success and how it could shape future energy use in Australia.

Your household participated in the first survey about 6 months ago, and we are now undertaking the final survey to see how the experiences of the participating households have changed over time, having used the products for a longer period. We have developed an updated online survey to achieve this.

[If background "RespondentCat" field = 5 add: We note that you chose to opt out of the trial, and as part of trial evaluation it is important for us to understand the experiences of both those that continued with their product, as well as those that opted out.]

The survey will take approximately 15 minutes and as a thank you for your time, if you complete the survey we will provide you a $20 shopping voucher.

To complete the survey, please go to <<insert link>>. The survey will close on 21st March 2014.

To find out more about the *Smart Grid, Smart City* initiative, please visit: http://www.smartgridsmartcity.com.au/

Your personal information from both the original and current survey will be kept confidential and only shared with Ausgrid, EnergyAustralia and the research institution undertaking the research for us. Only de-identified information from either survey will be used in any public documents that are released (i.e. it won't be linked to you). To view our privacy policy, please click here [If P=1-9 please insert a hyperlink to the Ausgrid privacy policy which is at: http://www.ausgrid.com.au/Common/About-us/Privacy-Policy.aspx If P = 10 -20 please insert a hyperlink to the EA privacy policy which is at: http://www.energyaustralia.com.au/privacy]. You can unsubscribe from receiving further survey and marketing information on *Smart Grid, Smart City* by emailing [If P= 1-9 then 'SGSC@ausgrid.com.au' if P = 10 – 20 then 'SGSC@energyaustralia.com.au'].

If you have any questions, please contact us on 1300 922 746 (Mon- Fri 9:00am- 5:30pm up to 28th March 2014).

Regards,

The [If P = 1 – 9 'Ausgrid' if P = 10 – 20 'Energy Australia'] *Smart Grid, Smart City* team

Thanks for making a difference

We appreciate your help with our *Smart Grid, Smart City* trial. The feedback we get from your home, and thousands of other participants, will help shape the future of energy use in Australia.

[Logo image]

A0b Introduction EMAIL TEXT – REPEAT Treatment Group – only where background "RespondentCat" field = 2 or 5

Dear [insert name]

Your household is currently one of a limited group trialling [If P = 1 – 9 'Ausgrid's' if P = 10 – 20 'Energy Australia's'] [P_L] as part of the Australian Government's *Smart Grid, Smart City* initiative. We are in the process of evaluating the project's success and how it could shape future energy use in Australia.

Your household participated in the first survey about 6 months ago, and we are now undertaking the final survey to see how the experiences of the participating households have changed over time, having used the products for a longer period. We have developed an updated online survey to achieve this.

[If background "RespondentCat" field = 5 add: We note that you chose to opt out of the trial, and as part of trial evaluation it is important for us to understand the experiences of both those that continued with their product, as well as those that opted out.]

The survey will take approximately 15 minutes and as a thank you for your time, if you complete the survey we will provide you a $20 shopping voucher.

To complete the survey, please go to <<insert link>>. The survey will close on 21st March 2014.

To find out more about the *Smart Grid, Smart City* initiative, please visit: http://www.smartgridsmartcity.com.au/

Your personal information from both the original and current survey will be kept confidential and only shared with Ausgrid, EnergyAustralia and the research institution undertaking the research for us. Only de-identified information from either survey will be used in any public documents that are released (i.e. it won't be linked to you). To view our privacy policy, please click here [If P=1-9 please insert a hyperlink to the Ausgrid privacy policy which is at: http://www.ausgrid.com.au/Common/About-us/Privacy-Policy.aspx If P = 10 -20 please insert a hyperlink to the EA privacy policy which is at: http://www.energyaustralia.com.au/privacy]. You can unsubscribe from receiving further survey and marketing information on *Smart Grid, Smart City* by emailing [If P= 1-9 then 'SGSC@ausgrid.com.au' if P = 10 – 20 then 'SGSC@energyaustralia.com.au'].

If you have any questions, please contact us on 1300 922 746 (Mon- Fri 9:00am- 5:30pm up to 28th March 2014).

Regards,

The [If P = 1 – 9 'Ausgrid' if P = 10 – 20 'Energy Australia'] *Smart Grid, Smart City* team

START OF SURVEY

A0a Introduction WEBSITE TEXT – Treatment Group

Thank you for participating in the *Smart Grid, Smart City* Survey. Your time is appreciated and your response will contribute valuable information for our research, which will help to shape the future of energy use in Australia.

[If background "RespondentCat" field = 1] At the end of the survey you will have the opportunity to win a $3,000 travel voucher or one of two iPad minis by submitting your best idea for reducing your electricity bills (click here for full terms and conditions).

[If background "RespondentCat" field = 2,3, 4, 5] As a thank you for your time, if you complete the survey we will provide you a $20 shopping voucher. Details of this will be provided at the end of the survey.

(For this first page only put a Start button, not a back and next)

A0d Confirmation of product

You have been trialling the [P_L] product. [If [P_L≠P_S] add 'Throughout this survey we will generally refer to this product as your "[P_S]".] [If P = 5, 6, 7, 11, 12, 13, 15, 16, 17, 19, 20 then add 'Please note that some questions may only ask you to consider one component of the product'.]

A2 Reason for participation **Do not ask if background "RespondentCat" field = 2 or 5**

Why did you choose to participate in this trial? You may choose more than one option.

Multiple answers allowed.

Reduce electricity bills 1
Reduce electricity consumption 2
Help the environment 3
Help the government 4
Interested in new technologies 5
I did not realise I had a choice to participate.....7
Other 6

If other, please describe:

B. HOUSEHOLD PROFILING

B2 Household Ages

How many people in your household fit into each of the following age groups?

Open Answer, Numeric (2 digits)

Young children	
Older children	
18-24	
25-34	
35-44	
45-54	
55-69	
70+	
Rather not say (please specify total number of people living in the household)	

Data Construction – Please provide a TOTAL column in data but do not get respondents to enter it. Include this in the same field as those that just gave the total in the 'rather not say' section.

B3 Language **Do not ask if background "RespondentCat" field = 2 or 5**
Is English the primary language spoken at home?

Single response.

Yes.....1
No 2

B4 Household Ownership **Do not ask if background "RespondentCat" field = 2 or 5**
Which of the following best describes your household's ownership of the house?

Single response.

Owned outright 1
Owned with a mortgage 2
Rented from a private landlord 3
Rented from private landlord with government financial assistance.....4
I live in a house owned by Housing NSW.....5
Other.....6

B5 Electricity supply priorities **Do not ask if background "RespondentCat" field = 2 or 5**
Thinking about the supply of electricity to your household, please rate the level of importance you place on the following issues:

Single response per row.

	Very Important	Somewhat Important	Neutral	Somewhat Unimportant	Very unimportant
Maintaining a reliable supply of electricity (i.e. little or no interruption to the power supply)	1	2	3	4	5
Cost of electricity bills	1	2	3	4	5
Safety concerns in regard to smart meters	1	2	3	4	5
Having access to information about your electricity use at the time you are using it	1	2	3	4	5
Receiving electricity supplied from renewable or lower greenhouse gas emission sources	1	2	3	4	5
Protecting the privacy of your energy consumption data	1	2	3	4	5

B6 Privacy

Regarding privacy of detailed household electricity consumption data more generally (not relating to the *Smart Grid, Smart City* trial), please rate your level of comfort over the sharing of your data with the following parties:

(Single response per line, please retain order – do not randomise)

	Very Comfortable	Somewhat Comfortable	Neutral	Somewhat Uncomfortable	Very Uncomfortable
Your electricity network operator (responsible for the poles and wires)	1	2	3	4	5
Your electricity retailer (responsible for billing and customer service)	1	2	3	4	5
Other electricity retailers	1	2	3	4	5
Government	1	2	3	4	5
Universities or research organisations	1	2	3	4	5
Third party providers offering new products or services to reduce costs or consumption	1	2	3	4	5

D3 Awareness programs

Who of the following do you think should be responsible for awareness and education programs about smart grid technologies? You may choose more than one option.

Multiple response. Only read out items in brackets if queried by respondent.

Governments 1
Electricity retailers (responsible for billing and customer service).....2
Electricity network operators (responsible for the poles and wires) 3
Smart grid technology vendors.....4
Other.....5
Don't know 6

If other, please describe:

B7 Preferred energy engagement

Which of the following statements do you align more closely with?

Single response per pair.

Pair 1:

I want more control over the cost of my electricity bill.....1

I want more control over the environmental impacts of my electricity use 2

Pair 2:

I want products that reduce my electricity bills by helping me understand and manage my electricity use 1

I want products that reduce my electricity bills without me having to think about it 2

B8 Energy Vulnerability – Financial

Have you felt financially unable to pay your energy bills at any stage over the last 12 months?

Single response.

Yes.....1

No 2

B9a Energy Vulnerability - Ability to Shift Time of Use

Consider a situation where you were charged twice the price for electricity use from 2-8pm on week days compared to other times. You may then choose to shift your use of appliances to other times of day.

For which appliances would you be UNABLE or UNWILLING to shift your use to outside of 2-8pm? You may choose more than one option.

Multiple responses allowed unless chooses "None".

None 0

Air conditioner 1

Heater 2

Lights.....3

Oven/Stove 4

Refrigerator 5

Television 6

Shower/bath 7

Clothes dryer 8

Other.....9

If other, please describe:

Data Construction – Please add in a column totalling the number of responses to this question.

B10 Household Income

What is your gross annual household income?

Single response.

$41,600 or less 1
$41,601 - $62,400 2
$62,401 - $80,000 3
$80,001 - $100,000 4
$100,001 - $140,000 5
Greater than $140,000 6
Don't know 7
Prefer not to say 8

C. GENERAL PRODUCT EXPERIENCE

-Non-activations-

C1 Non-Activated – Do not ask if background "RespondentCat" field = 2 or 5. This question is only for those customers who are marked as 'non-activated' in the supplied spreadsheet Once this question is answered, skip remaining questions and go to D4 to terminate survey, unless answer is 12, then continue to C2.
If P = 3, 4, 8, 9, 10, 14, 18 skip to C3
If P = 1, 2, 5, 6, 11, 12, 13, 15, 16, 17, 19, 20 ask Why didn't you activate your [B2]?
If P = 7 ask Why didn't you activate your [B2] and [B3]?

Single response.

Didn't receive product 1
Didn't receive an activation email 2
It was too difficult to set-up 3
It was too difficult to use 10
Product didn't work properly 11
I didn't see any value in the product 4
There wasn't enough information provided to me 5
I forgot or didn't get around to it 6
I didn't have enough time 7
I am now using it 12
Other 9

If other, please describe:

-Activated customers – general experience-

C2 Level of engagement –
If P = 3, 4, 8, 9, 10, 14, 18 skip to C3.

If P = 1, 2, 6, 11, 12, 15, 16, 19, 20 ask: How often do you use the [B2] that you are trialling?
If Respondent_Cat = 3 or 5 in background data and answers "Never", ask C2b, then D0, then go to D4 to terminate survey.
Otherwise, if "Never", ask C2b then go to D4 to terminate survey. If "Only once or twice", ask C2b then continue to C3. For all other answers ask C2c then continue.

If P = 5, 13, 17 ask: How often do you use the Online portal that you are trialling?
If Respondent_Cat = 3 or 5 in background data and answers "Never", ask C2b, then D0, then go to D4 to terminate survey.
Otherwise, if "Never", ask C2b then go to D4 to terminate survey.
If "Only once or twice", ask C2b now, then for this response and all other responses, repeat question with: How often do you view/control specific appliances through your portal?
If "Only once or twice" or "Never", ask C2b. Then go to C3.For all other responses skip to C2c.

If P = 7 ask: How often do you use the Online portal that you are trialling?
If "Only once or twice" or "Never", ask C2b now. Then for all, repeat question with: How often do you use the Energy monitor that you are trialling?
If "Only once or twice" or "Never", ask C2b.
Then, if "Never" for both parts of question and Respondent_Cat = 3 or 5 ask D0 then go to D4 to terminate survey. If Respondent_Cat = 1,2,4 go straight to D4 to terminate survey.
If "Only once or twice" for both parts of question, or one "Never" and one "Once or twice", go to C3. For all other combinations go to C2c.

Single response.

Daily 1
2-3 times per week 2
Once per week 3
Every now and then 4
Only once or twice 5
Never 6

C2b Level of engagement – ONLY ASK PARTICIPANTS ANSWERING "ONCE OR TWICE" (5) OR"NEVER" (6) AT C2

For "Never" (6) at C2: Why have you never used it? You may choose more than one option. [Then go to D4 to terminate survey OR return to ask second iteration of C2 question, as per instructions above]

For "Once or twice" (5) at C2: Why have you only used it once or twice? You may choose more than one option. [Then go to C3 OR return to ask second iteration of C2 question, as per instructions above]

Multiple responses.

(do not include if "once or twice") Didn't receive product 1
Didn't receive an activation email 2
It was too difficult to set-up 3
It was too difficult to use 10
Product didn't work properly 11
I didn't see any value in it 4
There wasn't enough information provided to me 5
I forgot or didn't get around to it 6
I didn't have enough time.....7
Other.....9

If other, please describe:

C2c Level of engagement over time – If P = 1, 2, 6, 11, 12, 15, 16, 19, 20 ask: Did you use it more, less or about the same over time?

If P = 5, 13, 17 ask: Did you use the Online portal more or less over time? Repeat question with: Did you use the appliance control features in your portal more or less over time?
If P = 7 ask: Did you use the Online portal more or less over time? Repeat question with: Did you use the Energy monitor more or less over time?

Single response.

More 1
About the same 2
Less 3

C2c1 Level of engagement over time [OPTIONAL]
If P = 1, 2, 5, 6, 7, 11, 12, 13, 15, 16, 17, 19, 20 ask: Please describe why [If P= 5,7,13,17 add "for both components of your product"].

Open answer:

C3 Understanding of product If P = 1,2,3,4,5,6,7,11,12,13,14,15,16,17,18,19,20 ask 'To what extent do you agree with the following statements, in relation to your [P_S]:'
If P = 7, ask 'To what extent do you agree with the following statements, in relation to your [B2]:' then repeat question for [B3]:
If P = 8,9, ask 'To what extent do you agree with the following statement, in relation to your [P_S]'

Single response statements and response categories.

	Strongly agree	Agree	Disagree	Strongly disagree
My household understands the potential benefits of this product	1	2	3	4
[If P = 8,9 don't ask] My household knows what to do to obtain these benefits	1	2	3	4
[If P = 8,9 don't ask] My household received enough information to take advantage of this product	1	2	3	4

--Product specific questions—

-Home energy assessment-

C4a Home energy assessment – Only ask if P=3. Do not ask if background "RespondentCat" field = 2 or 5
Was the SGSC Home Energy Assessment report easy to understand?

Single response.

Yes.....1
No 2
Unsure/I have not seen it 3

C4b Home energy assessment – Only ask if P = 3
What, if any, energy efficiency investments did you make, or will you be making in the near future, as a result of your [if background "RespondentCat" field = 2 or 5 say "SGSC Home Energy Assessment report" otherwise say "assessment"] recommendations??

Single response for each row.

	Not done or planned	Done in the last 6 months	Done longer than 6 months ago	Plan to do soon
1. Upgraded lighting	0	1	2	3
2. Upgraded heating	0	1	2	3
3. Upgraded air-conditioning	0	1	2	3
4. Purchased/used fans instead of air conditioning	0	1	2	3
5. Upgraded hot water system	0	1	2	3
6. Upgraded washing machine	0	1	2	3
7. Upgraded clothes dryer	0	1	2	3
8. Upgraded fridge	0	1	2	3
9. Upgraded other appliances	0	1	2	3

10. Added/improved Insulation	0	1	2	3
11. Installed efficient shower heads	0	1	2	3
12. Installed rooftop solar power	0	1	2	3
13. Improved or upgraded weather-stripping	0	1	2	3

Other, please describe: [mechanism to allow multiple others?]

14.	NA	1	2	3
15.	NA	1	2	3

C4c Home Energy Assessment - Only ask if P = 3 and answered "3" to any of the actions in C4b.
Why haven't you implemented your planned actions yet? You may choose more than one option.

Multiple responses allowed.

Haven't gotten around to it.....1
Do not have enough money at the moment 2
Don't know how/Not sure who to contact or how to follow up 3
Have other higher priorities.....4
Other.....5

If other, please describe:

-Peak event products-

C5a Peak Events-Worth it– Only ask if P= 4, 6, 14, 15,16, 17
In relation to the peak [If P=14-17, then add 'pricing'] events that are part of your product, do you feel the [if P = 4, 6 'rebate available is'; if P = 14-17 'potential savings to your bill are'] worth your effort in reducing your electricity use during these events?

Single response,

Yes.....1
No 2
Don't know 3

C5b Peak Events-Amount Network– Only ask if P= 4, 6 and C5a = 2 or 3
What would be the minimum rebate (in dollars per event) that would make it worth your while?

Single response

$1-5.....1

$6-10 2
$11-20 3
$21-30 4
$31-50 5
$>50 6
No amount of money would make me reduce use during peak events 0
Not sure 9

C5b2 Peak Events-Amount Retail– Only ask if P= 14, 15,16, 17 and C5a = No
What would be the minimum amount of money saved (in dollars per bill) that would make it worth your while?

Single response

$1-5 1
$6-10 2
$11-20 3
$21-30 4
$31-50 5
$51-70 6
$71-100 7
$>100 8
No amount of money would make me reduce use during peak events 0
Not sure 9

C5c 1Peak Events-SMS – If P= 4, 6, 14, 15, 16, 17 and 'Peak Event Count' column in background data >0
Did you or your household receive any SMS messages advising of a peak [If P=14-17, then add 'pricing'] event?

Single response

Yes 1
No 2
I don't know 3

If 'No' or 'I don't know', ask C5c2 then skip to C5d
If 'Yes', skip to C5c

C5c 2Peak Events-SMS – If P= 4, 6, 14, 15, 16, 17 and 'Peak Event Count' column in background data >0 and answered 'No' or 'I don't know' to C5c1
Were you the person registered to receive the SMS messages?

Single response

Yes.....1
No 2
I don't remember.....3

Skip to C5d

C5c Peak Events-SMS – If P= 4, 6, 14, 15, 16, 17 and 'Peak Event Count' column in background data >0
Regarding the occasions you were contacted to participate in a peak [If P=14-17, then add 'pricing'] event, did the SMS messaging provide you with adequate information regarding the peak event? If no, please explain.

Single response

Yes.....1
No 2

If no, please explain why:

C5d Peak Events Participation –Only ask if P= 4, 6, 14, 15,16, 17 and 'Peak Event Count' column in background data >0
If P= 4, 6 ask 'As a result of any peak events did you receive any rebates (to the credit card provided for the trial)?'
If P = 14,15,16,17 ask 'Did you reduce your electricity consumption during any peak pricing events?'

Single response

Yes.....1
No 2

If yes, ask C5d1 then Skip to C5d3
If no, skip to C5d2

C5d1 Peak Events-Flow on– Only ask if P= 4, 6, 14, 15,16, 17; and 'Peak Event Count' column in background data >0; and C5d = 'Yes'
Has reducing your electricity consumption during peak event(s) had a flow-on effect to how much electricity you and the other people in your home use at other times?

Single response.

Yes.....1

No 2

Skip to C5d3

C5d2 Peak Event– not participate – Only ask if P= 4, 6, 14, 15,16, 17 and 'Peak Event Count' column in background data >0 and C5d = 'No'

What prevented you from reducing your electricity consumption during peak [If P=14, 15, 16, 17, then add 'pricing'] events? You may choose more than one option.

Multiple responses allowed.

Not at home during peak events, so it was not a choice for me 1

[if P = 4,6 'Rebate', if P = 14-17 'Peak event price'] not high enough to bother.....2

Did not get SMS regarding peak event 3

Difficult to change my electricity consumption during peak events 4

Other.....5

If other, please describe:

C5d3 Peak Events Over Time –Only ask if P= 4, 6, 14, 15, 16, 17 and 'Peak Event Count' column in background data >1

Over time, as more peak events have been called, how has your interest in participating in the peak events changed?

Single response.

A lot more interested in participating 1

A little more interested in participating 2

About the same 3

A little less interested in participating 4

A lot less interested in participating 5

C5d3a Peak Events Over Time –Only ask if P= 4, 6, 14, 15, 16, 17 and 'Peak Event Count' column in background data >0

Please describe why.

Open answer:

C5d4 Peak Events Extreme –Only ask if P= 4, 6, 14, 15, 16, 17

Please indicate which of the following statements you align more closely with:

Single response per pair.

Pair 1:

During a **winter peak event**, I would heat my house:

Less to save money, no matter how cold the day	1
Less only on a moderately cold day, but would pay more to heat my home on extremely cold days	2

Pair 2: (Only ask if background data indicates customer has air conditioning)

During a **summer peak event**, I would use my air-conditioner:

Less to save money, no matter how hot the day	1
Less only on a moderately hot day, but would pay more to cool my home on extremely hot days	2

--Home energy feedback technologies—

C7b Mobile application - Only ask if P = 1, 2, 5, 7, 12, 13, 16, 17, 20 and MOBILE_PORTAL = MAYBE or NO in background info

Were you aware that a Mobile Application was available to view your information from a smart phone or other portable internet-enabled device?

Single response.

Yes.....1
No 2

If yes, and MOBILE_PORTAL = MAYBE in background data, continue to C7b1
If yes, and MOBILE_PORTAL = NO in background data, go to C7c,
If no skip to C8

C7b1 Mobile application - Only ask if P = 1, 2, 5, 7, 12, 13, 16, 17, 20 and MOBILE_PORTAL = MAYBE in background info

Did you ever try the mobile application to view your electricity use?

Single response.

Yes.....1
No 2
Can't remember.....3

If 1 (yes), skip to C7
If 2 or 3, continue to C7c

C7c Mobile application - Only ask if P = 1, 2, 5, 7, 12, 13, 16, 17, 20 and background info indicates that mobile application was NOT used, AND answered 'Yes' to C7b.

Why didn't you use the mobile application? You may choose more than one option.

Multiple response.

Didn't get around to downloading it 1
Did not have access to a suitable device 2
Did not think the mobile app would be useful 3
I would rather use the desktop computer version of the portal 4
Other.....5

If other, please describe:

Continue to C8

C7 Mobile application - Only ask if P = 1, 2, 5, 7, 12, 13, 16, 17, 20 and either background info indicates that mobile application WAS used or answer to C7b1 above = yes

Do you prefer to use the mobile application or the desktop portal to view your electricity use?

Single response.

Mobile application 1
Desktop portal 2
Both about the same 3

C8 Ease of use– Skip if P = 3, 4, 8, 9, 10, 14, 18.
If P = 1,2,11,12,15,16,19,20 ask 'How easy were each the following?'
If P = 5,7,13,17, ask 'For your [B2], how easy or difficult were each the following?' then repeat for [B3], replacing [B_2] below with [B_3]

Single response per row.

	Very Easy	Easy	Neither easy nor difficult	Difficult	Very difficult	Not sure
Setting up your [B_2]	1	2	3	4	5	6
Using your [B_2]	1	2	3	4	5	6

C8a Ease of use over time – Skip if P = 3, 4, 8, 9, 10, 14, 18. Only ask if background "RespondentCat" field = 2 or 5

"How has the ease of use of your product changed over the last 6 months, since you completed the first survey?"

Single response.

Become a lot easier 1
Become a little easier 2

Not changed 3

Become harder 3

C9c1 Product problems/faults Do not ask if P= 3
Did you have any technical problems or faults with your [P_S]?

Single response.

No 1

Yes.....2

If "No" skip to C9d1, If "Yes" ask C9c2.

C9c2 Product problems/faults
What were they?

Open Answer, Qualitative.

C9d1 Product dislikes
Were there any aspects that you didn't like about your [P_S]?

Single response.

No 1

Yes.....2

If "No" skip to C19, If "Yes" ask C9d2.

C9d2 Product dislikes
If yes, what were they? You may choose more than one option, or describe under 'other'.

Multiple response.

[Do not show if P= 3, 4, 8, 9, 10, 14, 18] Information on portal or monitor difficult to understand/interpret 1

Wanted more/better/different energy use data provided 2

[Do not show if P=3, 4, 8, 9, 10, 14, 18] Energy data provided seemed unreliable 3

[Do not show if P=3, 4, 8, 9, 10, 14, 18] Wanted energy data closer to real time 4

The connection between taking action and achieving bill savings was not clear enough 5
Still too long a period between receiving bills 6
Getting help (via helpline) was difficult 7
[Only show if P= 4,6,10-20] Confused/upset by pricing 8
Other 9

If other, please describe:

Data Construction – Please add in a column totalling the number of responses to this question.

--Home energy feedback technologies - with retail tariff—

C10a Bill estimation: Only ask if P= 12,13,16,17,20.
How important was the estimation of your bill generated by your Online portal as a tool in driving your behaviour change?

Single response.

Very Important 1
Important 2
Neutral 3
Unimportant 4
Very unimportant 5
Didn't use 5

If response was "Didn't use" skip to C10c.

C10 Bill estimation: Only ask if P= 12,13,16,17,20 Do not ask if response to C10a was 'Didn't use'
How accurate did you find the bill estimation?

Single response

Very accurate 1
Mostly accurate 2
Mostly inaccurate 3
Very inaccurate 4

C10c Balance estimation: Only ask if P= 10, 11, 12 and 13

If you received a low or debit balance estimation SMS, did this prompt you to top your account up? If not, why?

Single response.

Yes.....1
No 2
Did not receive low balance SMS.....3

If no, why?

C11 Home Control: **Only ask if P= 5, 13 or 17**
Did you have any concerns about using your appliance control features?

Single response

Yes 1
No 2

If yes, for which appliances?

Open answer

C6 Amount of information – Only ask if P = 1,2,5,6,7,11,12,13,15,16,17,19,20.
If P = 7 ask for [B2] then repeat with [B3] (with B3 replacing B2 in question)
Would you rate the overall amount of information provided by your [B2] as:

Single response.

Not enough 1
About right.....2
Too much 3

C13 Product features
Please rate how useful the following features of your product(s) were.

(Single response per line)

The table below shows the relevant features of the products. The left hand column shows the Product (P) numbers that are relevant for that feature. Please adapt the table to only show the relevant features.

For each feature please include a response scale of 1. Very useful, 2. Somewhat useful, 3. Not very useful, 4. Not at all useful

Relevant Products	Feature
1,2,5,6,7,11,12, 13,15,16,17,19,20	[If P=2,6,11,15,19 say "Being able to set the monitor to show" otherwise say "Being able to see"] how much electricity (in kWh) you are using at the time you are using it
1,2,5,6,7,11,12, 13, 15,16, 17,19, 20	[If P=2,6,11,15,19 say "Being able to set the monitor to show" otherwise say "Being able to see"] your electricity use over a period of time
2,6,7,11,15,19	Being able to see how much electricity (in dollars) you are using at the time you are using it
1,2,5,6,7,11,12, 13,15,16,17,19,20	[If P=2,6,11,15,19 say "Being able to set the monitor to show" otherwise say "Being able to see"] how much your electricity use has cost you over a period of time
12, 13, 16, 17, 20	Bill estimation and budgeting feature that shows your estimated cost to date and whole bill cost
12, 13	Account balance estimation showing current balance and projected balance
1,2,5,6,7,11,12, 13,15,16,17,19,20	Receiving messages about your account or energy efficiency tips
1,5,7,12, 13,16, 17, 20	Being able to track greenhouse gas emissions
5,13, 17	Being able to turn appliances on and off
5,13, 17	Being able to see appliance usage at the time you are using it
5,13, 17	Being able to track appliance usage over a period of time

C14 Perception of savings

How much money do you think your [P_S] saved you off each electricity bill during the trial?

(Single response)

None 1
Less than $15 2
$15 - $29 3
$30 - $45 4
$46 - $100 6
Over $100 7

C14a Perception of savings

[if P = 4, 6 'Were the rebates you received'; if P = All other products 'Were the savings you achieved on your bill'] more, less or about the same as you anticipated?

Single response.

A lot more 1
A little more 2
About the same 3

A little less.....4

A lot less.....5

C15 Energy literacy and control

Please indicate what effect your [P_S] has had on each of the following:

(Single response per line)

	Increased it a lot	Increased it a little	No impact	Decreased it a little	Decreased it a lot
Your awareness of your electricity use	1	2	3	4	5
Your control over your electricity use	1	2	3	4	5
Your ability to reduce your electricity bills	1	2	3	4	5
If P = 10-13 only: Your ability to budget your electricity use	1	2	3	4	5
Your ability to evaluate the costs and benefits of pricing structures offered by electricity companies	1	2	3	4	5
Your confidence in responding to new offers from electricity companies	1	2	3	4	5

C15a Energy literacy and control over time **Only ask if background "RespondentCat" field = 2 or 5**

"Now specifically in the last 6 months (since you completed the first survey), how has the [if P=3, say "additional time since", else say "continued use of"] your [P_S] changed the following?"

Single response per row.

	Increased it	No change	Decreased it
Your awareness of your electricity use	1	2	3
Your control over your electricity use	1	2	3
Your ability to reduce your electricity bills	1	2	3
If P = 10-13 only: Your ability to budget your electricity use	1	2	3
Your ability to evaluate the costs and benefits of pricing structures offered by electricity companies	1	2	3
Your confidence in responding to new offers from electricity companies	1	2	3

C16 Product satisfaction

Overall, to what extent would you say you are satisfied with the performance of your [P_S]? Please try to answer for your product as a whole.

(Single response)

Very satisfied 1
Satisfied 2
Neither satisfied nor dissatisfied 3
Dissatisfied.....4
Very dissatisfied.....5

C16a Product satisfaction over time Only ask if background "RespondentCat" field = 2 or 5

"How do you think your level of satisfaction with your product [P_S] has changed over the last 6 months, since you completed the first survey?"

Single response.

Increased a lot 1
Increased a little 2
No change.....3
Decreased a little.....4
Decreased a lot.....5

C16b Product satisfaction over time - reason – Only ask if background "RespondentCat" field = 2or 5

Please describe why.

Open answer:

C17a Energy saving and load shifting

Since If P=3 'your [P-S]' else 'starting to use your [P_S]' have you and the other people in your home made any changes to <u>how you use the following</u> electrical appliances?

If so, how? You may choose more than one option.

Multiple response per appliance, unless Z or A is selected. Do not show Letters in the heading row.

Data construction: Please include the columns as per usual (ie. Yes/No for every combination of 1-16 and B-E) but also include an additional summary column for each appliance (ie. 1-16) using the following codes:

99. Does not have the appliance
0. Has the appliance but did not make any changes
1. = B only
2. = C only
3. = D only

4. = E only
5. = B &C
6. = B & D
7. = B & E
8. = C & D
9. = C & E
10. = D & E
11. = B, C, D
12. = B, C, E
13. = B, D, E
14. = C, D, E
15. = B, C, D, E

	Z. Do not have appliance	B. Reduced stand-by usage (e.g. turned off at wall)	C. Reduced duration or intensity of usage	D. Changed time of usage (e.g. delay start)	E. Upgraded to more efficient model	A. Did not change
1. Air conditioner	99	N/A				0
2. Heater	99	N/A				0
3. Lighting	99	N/A				0
4. Television	99					0
5 Computers or other personal devices	99					0
6. Other home entertainment	99					0
7. Dishwasher	99					0
8. Washing machine	99					0
9. Clothes dryer	99					0
10. Iron	99	N/A				0
11. Kettle	99	N/A				0
12. Oven/Stove	99	N/A				0
13. Microwave	99					0
14. Refrigerator	99	N/A				0
15. Shower/bath	99	N/A				0
16. Pool pump/filter	99					0

If other, please describe, separately: [mechanism for multiple others?]

17.	99					0
18.	99					0

C19 Behaviour Change Experience **If answers to all part of C17 = A1 or A2 then skip otherwise ask**

When thinking about the changes you made to your energy use since using your [P_S], which of these statements best reflects your experience?

Single response

I had to significantly alter my daily routine 1
I had to make some changes to my daily routine 2
My daily routine was not affected 3

If answered 1 or 2, ask C19b. If 3, skip to C20a

C19b Behaviour Change Experience **Only ask if answered '1' or '2' to C19**
How easy or difficult was it to make these changes to your routine?

Single response

Very easy 1
Somewhat easy 2
Somewhat difficult/inconvenient 3
Very difficult/inconvenient 4

C20a Fatigue **Only ask if any part of response to C17a = B, C or D.**
Of the changes you made to your energy use since first using your[P_S], what proportion are you still doing?

Single response.

All 1
More than half 2
About half 3
Less than half 4
None 5

C20ai Fatigue over time **Only ask if background "RespondentCat" field = 2 or 5. Only ask if C17 = B,C or D for ANY appliance.**
"Do you think you are doing more or less of these behaviour changes now, than you were 6 months ago when you completed the first survey?"

Single response.

A lot more 1
A little more 2
The same 3
A little less 4
A lot less 5

C20b Fatigue Do not ask if response to C20a = "All"

Of those behaviour changes that you started and then stopped, what would have assisted you in continuing with them? You may choose more than one option.

Multiple responses.

Higher financial incentives.....1
Being able to see tariff/savings in real time 2
More or better feedback information on my usage 3
Better knowledge about energy use generally 4
Regular/frequent reminders or alerts 5
Peak periods occurring at different times 6
More participation by other household members 7
Better personal organisation/less laziness 8
Other lifestyle factors (e.g. different job, kids).....9
Nothing could help 10
Don't know 11
Other.....12

If other, please describe:

C18c Peak Event Load Shifting Only ask if P = 4, 6, 14, 15, 16, 17 and answer to C5d = 'Yes'

Now thinking only about 'peak events' that were called as part of your product, were the behaviour changes your household made during these events different from those at other times?

Single response.

Yes.....1
No 2
We did not make any behaviour changes during peak events 3

C18d Peak Event Load Shifting Only ask if P = 4, 6, 14, 15, 16, 17 and answer to C5d = 'Yes'

Which of the following actions did you undertake on days on which the peak events occurred? You may choose more than one option.

Multiple responses allowed.

Turned off electricity at the mains 1
Turned everything off and left the house during the peak event.....2
Turned off refrigerator 3
Did not use other major appliances that day 4
Waited until after the peak event ended to use other major appliances 5
Did not use smaller appliances that day.....6

Waited until after the peak event ended to use smaller appliances 7
Other 8

If other, please describe:

Data Construction – Please add in a column totalling the number of responses to this question.

C12 Energy Efficiency Handbook
How useful did you find the Energy Efficiency handbook that was sent to you by post in June/July?

Single response.

Very useful 1
Somewhat useful 2
Not very useful 3
Not at all useful 4
Did not receive 5
Have not read it yet 6

D. WRAP UP & END OF SURVEY

D0 Opt Out **Only ask if Respondent_Cat = 3 or 5 in background data**
Why did you opt out of the trial? You may choose more than one option.

Multiple responses.

Age barrier - too old to use product 1
Incorrectly signed up 2
Did not like product 3
Didn't feel like I saved any money 4
Product didn't work 5
Not interested in smart meters 6
Inconvenient - meter change, bill change, etc 7
Moved retailer 8
Moved house 9
Misunderstood offer/trial 10
Product too complicated 11
Doesn't want time-of-use based pricing 12
Other 14

Rather not say.....13

If other, please describe:

D1 Recommend to others
On a scale of 1-10 where 1 is extremely unlikely and 10 is extremely likely, how likely are you to recommend a [P_L] to a friend?

Open Answer, Numeric (2 digits).

D1b Recommend to others
Why?

(Open Answer, Qualitative. Not compulsory. Allow skipping by clicking next)

D1c Recommend to others over time **Only ask if background "RespondentCat" field = 2 or 5**
"How do you think your likeliness to recommend your product to others has changed over the last 6 months, since you completed the first survey?"

Single response.

Increased a lot 1
Increased somewhat 2
No change.....3
Decreased somewhat 4
Decreased a lot.....5

D2 Continue to use **Do not ask if P=3**
The following question does not commit you to anything, and is just to help us gauge if your product was useful. If [P_S] was available as an option from your energy provider would you be interested in using this product again?

Single response.

Yes.....1
No 2
Maybe.....3

D4 Testimonial

Do you have any other, or overall, thoughts or reflections on your participation in this trial?

Open Answer, Qualitative. Response not compulsory

D5 Prizedraw - Game of skill **ask only if background "RespondentCat" field = 1**

If you would like to have the opportunity to win a $3000 Travel voucher or one of two iPad Minis please provide us, in 25 words or less, your best idea for reducing your electricity bills.

The prizes will be awarded on the 25th April 2014, with the most innovative and interesting ideas being chosen as winners of the prizes. We will contact the winners by email and/or telephone call. The winners will also be posted on the Smart Grid, Smart City website. If you would like more information on the terms and conditions please click here

Open Answer, Qualitative.

D5b Individual Incentive **ask only if background "RespondentCat" field = 2, 3, 4 ,5**

We've reached the end of the survey. As a thank you for your time, we would like to offer you a $20 shopping voucher, which you will receive in a few weeks' time. Please indicate the address you would like the voucher sent to.

Name	
Address 1	
Address 2	
Suburb	
State	
Postcode	

D5c Additional Interview **ask only if P=8,9 OR background "INTERVIEW" field = Yes**

Thank you for providing some great feedback on the trial.

In a few days' time we will be carrying out a limited number of telephone interviews to gather additional information and quotes from trial participants. This information will be used in case studies on the trial to be shared with the general public.

The case studies would include only your first name and any interesting quotes about your experience.

The interview should take no more than 15 – 20 min and as a thank you for your time, we're offering an additional $30 shopping voucher to all interview participants.

Would you be happy for us to pass on your contact details and survey responses to our interviewer for a potential interview?

Single response.

Yes.....1
No 2

D6 End of survey text
If you have any further questions or comments about your product or your participation in the trial, please don't hesitate to visit the website, call or e-mail us.

Thank you very much for your time. If you have any further questions or comments about your product or your participation in the trial, please don't hesitate to visit the website www.smartgridsmartcity.com.au, or contact us on [If P= 1-9 then 'SGSC@ausgrid.com.au' if P = 10 – 20 then 'SGSC@energyaustralia.com.au'] or, up to 28th March 2014, on 1300 922 746 (Mon-Fri 9:00am- 5:30pm)

Click next to submit your answers and finish the survey.

UNIVERSITY OF
TECHNOLOGY SYDNEY

Institute for
Sustainable
Futures